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ELECTRIC TRACTION TO EASTBOURNE AND HASTINGS

This month our Electric Railway Traction Supplement (presented with each copy of this week's issue) is devoted entirely to the Southern Railway main line electrification to Eastbourne and Hastings.

Further Southern Electrification

BY extending electrification to Eastbourne and Hastings the Southern Railway has logically concluded what might be called the second stage of main line electrification. The probability of rapid development along the South Coast was doubtless the controlling factor that decided the Southern Railway authorities when they electrified to Brighton to construct the central control room at Three Bridges in such a way that electrification further east could be incorporated without any alteration or extension of the equipment installed for the purely Brighton and Worthing traffic. Actually the control room at Three Bridges covers the line almost as far as Eastbourne, namely to Willingdon Junction, and a new control room at Ore covers the rest of the line. Here again the fact that Ore, the extreme eastern limit of electrification, was chosen for the new control room points to the probability of further extension eastward, and it may not be many years before the whole south-eastern corner of England is served by electric trains. Increase of traffic on the main line to Brighton and Worthing since the institution of electric traction on January 1, 1933—already recorded more than once in these pages—is an earnest of what may be expected from the improved services about to be provided on the Eastbourne and Hastings line and of which we give a detailed description in the supplement presented with this issue.

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An Overcrowding Impasse

In discussing the suburban services from Liverpool Street with representatives of the press on Monday (see page 1267), Col. H. H. Mauldin, Superintendent (Eastern Section), L.N.E.R., admitted that even the electrification and resignalling of all lines to Shenfield envisaged by the company with its share of the Government-guaranteed loan for London transport improvements, would not abolish overcrowding on the Ilford trains at all times. Seating accommodation in the electric trains would be substantially as at present owing to the space occupied by luggage and motor compartments in three-unit sets. Open coaches would afford more room but fewer seats, and the people of Ilford are determined to be seated. Nevertheless, appeals from the same quarter have been raised for an eastward extension of the Central London tube, in which case the London Transport policy of recognising that where all cannot sit down the best compromise is to make proper provision for those who have to stand, would presumably be accepted. The L.N.E.R. is forced, however, to fulfil the demand for seats by providing narrow compartments, where standing is synonymous with overcrowding, as it need not really be. This attempt to please everybody, resulting in 190 passengers being seated per 100 ft. of train, has the usual result of earning the company more abuse than gratitude.

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The Week's Traffics

General satisfaction is felt with the traffic returns for the past week of the four group companies which exceeded expectations, and the increases in merchandise and coal (except for a small decrease in merchandise on the Southern) are particularly welcome. For the 25 weeks of the year to date the respective advances in passenger train traffics are L.M.S.R. £243,000, L.N.E.R. £191,000, Southern £133,000, and Great Western £49,000. Merchandise earnings for the 25 weeks are up £22,000 on the Great Western and up £4,000 on the L.M.S.R., but are down £80,000 on the L.N.E.R. and £104,500 down on the Southern. The L.M.S.R. alone has an increase (£11,000) in coal class receipts to date, the decreases by the three other companies being L.N.E.R. £147,000, Great Western £38,000, and Southern £39,500.

	25th Week				Year to date.	
	Pass., &c.	Goods, &c.	Coal, &c.	Total.	Inc. or dec.	
	£	£	£	£	£	%
L.M.S.R.	+ 15,000	+ 1,000	+29,000	+ 45,000	+ 258,000	+ 0·94
L.N.E.R.	+ 3,000	+ 18,000	+13,000	+ 34,000	− 36,000	− 0·18
G.W.R.	+ 10,000	+ 10,000	+10,000	+ 30,000	+ 33,000	+ 0·29
S.R.	+ 5,000	− 2,500	+ 500	+ 3,000	− 11,000	− 0·12

London Transport receipts for the week were £546,200, a decrease of £900, and for the 51 weeks £27,449,100, an increase of £571,400.

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Encouraging Air Travel

In the early days of the railways many people were frightened to travel by train, because they found it difficult to believe that man had reached that stage when by his own ingenuity he had devised a means of transport that shattered all past conceptions of the invincibility of time and space. The railway, however, soon solved its own problem. Men could not for long shut their eyes to the accomplishments of the engineer when they began to see railway systems appearing wherever they might

go throughout the length and breadth of the land. The railways advertised themselves. Unfortunately the aeroplane is not in the same fortunate position; a mere speck in the sky, its publicity value is little. To make people conscious of developments in the air is, therefore, a task far more difficult than that which faced the Stephensons in 1830. The railways are doing much to encourage the public to regard flying as a normal means of transport, but it is a great pity that the nervous cannot be induced to visit a commercial airport and there see for themselves how ill-founded are the fears which hold them back. At Southampton, to take as an example a provincial centre, the simple efficiency which marks the arrival and departure of planes for a variety of internal destinations and the Channel Islands is a model of what modern transport service should be, and it would undoubtedly dispel completely the uncertainties of most people. (See also page 1262.)

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Railway Ribaldry

The Great Western Railway has performed yet another public service by commissioning Mr. W. Heath Robinson to illustrate some of the landmarks in its history. In the fact that they call forth decided opinions, the cartoons of this artist have something in common with the sculpture of Mr. Epstein; here, however, the resemblance ends, for Mr. Heath Robinson's works earn universal approval, and are intelligible to all their admirers. In "Railway Ribaldry" he has gone one better than usual. We expect him to give us lucid mechanics without calculations, but to this he has added entertaining history without dates. A fruitful source of dispute is thereby abolished, so that the dry cackle of the scholar can mingle unrebuked with the guffaws of the ignorant. Elsewhere in this issue we review Mr. Heath Robinson's handiwork, and in accordance with our usual custom give statistical particulars which will assist the prospective purchaser to assess the return in cubic inches on his outlay. It should be added here, however, that he will also be acquiring something unique in railway centenary literature, and a book which, like the Great Western company itself, improves with long acquaintance.

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Mr. Cecil J. Allen

Close upon the centenary of THE RAILWAY GAZETTE has come another record in railway journalism. Our associated contemporary, *The Railway Magazine*, publishes in its July issue the three hundredth article by Mr. Cecil J. Allen on "British Locomotive Practice and Performance." The series has appeared month by month, with but one break, due to unavoidable circumstances, since 1911, and prior to that Mr. Allen had contributed the feature quarterly for a year and a half, as a successor to its founder, the late Mr. Charles Rous-Marten. That his articles are studied and used by those directly concerned with the design and operation of locomotives is evident from the correspondence Mr. Allen receives and discusses in his articles, while the value of his services as a liaison officer between the railways and the large section of the public interested therein, not only as a journalist but as author, lecturer, and broadcaster, must be literally inestimable. It must not be supposed that Mr. Allen is merely an amateur enthusiast, for there is probably no greater authority on the subject of train speeds, the factors which govern them, and their evidential performance value in connection with improvements in locomotive design. Mr. Allen also frequently contributes to our own pages on this topic, but his name is probably best known to readers of THE RAILWAY GAZETTE and *The Railway Engineer* as an authority on the steel rail, on which subject he has for many years contributed signed articles. His work on this subject has probably done much to influence the recent adoption in the British Standard Specification of the medium manganese rail.

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Railways and Education

In recent weeks we have made various references to the enterprise of the L.N.E.R. in organising or encouraging educational travel for school children. A similar undertaking by the Southern Railway is the arrangement of excursions from schools in Kent to Southampton, where a visit to a liner and a comprehensive tour of the docks, in charge of guides furnished by the Docks and Marine Manager, takes place. The trains to Southampton, each conveying about 500 children, usually include restaurant cars for the sale of light refreshments and the service of teas on the return journey, thereby making the arrival home at a conveniently early hour. The company's arrangements also include the preliminary distribution of notes on the docks, as well as on places of interest to be seen *en route*, so that the maximum instruction is derived and digested from the outings as a whole. Many appreciative letters have been received since the first of these excursions was run on May 10 last. Thirty-one have been arranged between that date and July 14, and it is expected that more may be called for early in the next school term.

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Anomalies in Mexico

Mr. Vincent W. Yorke, Chairman of the Mexican Railway, announced at the meeting last Wednesday (reported on page 1275) that the company was faced with an essential expenditure of nearly £200,000 in the next two years on new locomotives, rolling stock and equipment. At the same time the railway is harrassed by labour disputes which have already entailed the sacrifice of half its monthly net earnings, despite the fact that salaries in Mexico have a disproportionate purchasing power due to the devaluation of the peso. Certain engine drivers, for example, are receiving the equivalent of at least £116, £104, and £92 a month. Necessities of life are at such low prices as 6d. a pound for best beef and 1s. a gallon for milk, while as to luxuries Mr. Yorke assured the shareholders that a first rate cigar could be bought for 3d. The labour unions, however, continue to press for concessions, and even without yielding further the company expects that its renewals programme will require nearly three years' earnings and leave no margin during that time even for debenture interest. The most hopeful sign for the future seems to be a recent reconstruction of the Cabinet which may result in the situation being equitably considered.

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Signal Engineers in Belgium

Belgium is the rendezvous this year of many railway pilgrims, for not only have the Belgian railways attained their centenary, but they have been in recent months the subject of many outstanding developments. Further, there is in progress the great Brussels Exhibition, in which much of railway interest is displayed. It was therefore appropriate that the Institution of Railway Signal Engineers should have had its annual summer meeting in Belgium, the more so in that the new electric power signalling installation at Brussels Nord, introduced in connection with the first main line electrification in Belgium

—between Brussels and Antwerp—had recently been brought into operation. Our article in THE RAILWAY GAZETTE of June 14 on signalling in Belgium made reference to this new installation, but mainly described the very efficient signalling system in use throughout the Belgian National Railways today. We have recently described and illustrated the latest express locomotives introduced on the Belgian railways, and on page 1267 of this issue we briefly outline the summer train service accelerations, some of which have been made possible by this new equipment. In our issue of January 25 last we described the new all-metal passenger rolling stock which has been introduced on a large scale on the Belgian National Railways. Our readers will thus be aware of the outstanding developments which have taken place of recent years and which have now brought the Belgian railways up to a standard second to none.

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Accident Inquiries in Private

The fact that Colonel Mount held part of the Welwyn Garden City inquiry of June 20 in private created a suspicion among the popular press that the railway company had something to hide. Such was not, however, the case; that part of the inquiry not held in public was when the men directly concerned in the cause of the accident gave their evidence. As Colonel Mount said at the opening of the proceedings, his investigation was for the purpose of discovering the cause, in order that, if necessary, steps might be taken to prevent a recurrence. Towards that end the men are encouraged to speak as freely as they probably have already done in private to their superior officers, and since such evidence does not become publicly known, any legal steps that might be taken, in the event of carelessness, are not assisted. The company's officers, too, may ask questions with a freedom they would not use if in public. Furthermore, the Inspecting Officer's report is not made public until any criminal proceedings that may have been initiated are over, or there is no likelihood of such being taken. In all these circumstances the Inspecting Officer is himself the authority as to what, if any, evidence shall be taken in private.

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The Buckeye Coupling

Whilst it was not until the derailment of the 5.45 p.m. express from King's Cross to Leeds at Newark on September 6, 1915, that the buckeye coupling was mentioned in an accident report, as having kept all eleven vehicles, except the seventh, upright, it would appear that, although not recorded in the reports, it mitigated the effects of two earlier serious derailments. On September 9, 1913, the 11.45 p.m. King's Cross to Edinburgh had all its six coaches derailed at Chevington, but they remained standing upright. On December 21, 1914, the 5.30 p.m. King's Cross to Newcastle had six vehicles derailed when running at high speed at Littleburn, but all the coaches on the train remained coupled together. The same effect attended the derailment of the leading seven carriages of the eleven on the 11.30 p.m. Edinburgh to King's Cross at Scremerston on May 19, 1916. Following the Newark accident the buckeye coupling was mentioned a second time, after the accident at Alne, on December 19, 1917, when the third coach on the 10 a.m. from Edinburgh to King's Cross had a broken axle. It was then said that the remainder of the train behind the fourth vehicle was still on the rails and all the couplings were intact. Colonel Druitt, who reported on the Newark accident mentioned above, was himself a passenger on the train and it is significant, in view of Mr. Gresley's testimony at the Welwyn accident inquiry on June 20, that the Newark report said, " these (buckeye) couplings are very strong and it is possible that the small damage done to the train, although derailed when running at a speed of from 60 to 70 m.p.h., was due to the strength of the coupling keeping the carriages connected together, one behind the other, in a more or less direct line, thus preventing any tendency for one or more to get broadside on to the others and for the underframe of one car to ride over that of the next one to it, resulting in one telescoping the other."

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Neck-and-Neck

In the railway speed race the game fight which is being put up by century-old steam propulsion against its newest diesel rival can hardly escape admiration. Indeed, " neck-and-neck " does not inaptly describe the present stage of the contest. Maximum speeds up to 120 m.p.h. have been claimed for some of the latest diesel-driven units, such as the Union Pacific train now installed on the Chicago-Portland service, but these for the most part appear to be approximations, as compared with the definite 118·9 m.p.h. attained by one of the new German high speed 4-6-4 steam locomotives, which for a considerable stretch of the Berlin-Hamburg route maintained speeds of 100 to 108 m.p.h. with a 200-ton train. As to scheduled speeds of services in which steam and diesel power are now in direct competition, the competing flyers between Chicago and the Twin Cities offer an interesting example. Here the Hiawatha, streamlined six-coach steam-hauled express of the Chicago, Milwaukee, St. Paul & Pacific RR., is pitted against the Zephyr, three-car diesel-operated train of the Chicago, Burlington & Quincy RR. Both require 6½ hr. for the run between Chicago and St. Paul, the former over a route 410 miles in length, and the latter over 431 miles. But it is not the diesel-operated Zephyr that makes the fastest scheduled start-to-stop run. The Zephyr's best is 116 miles in 95 min., which works out at 73·6 m.p.h.; but the Hiawatha covers one stretch of 43·1 miles in 35 min., at 73·9 m.p.h.

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Locomotive Performance in America

The variations due to service conditions in the mileage which a locomotive may be expected to complete between heavy overhauls, makes it impossible to do more than draw an average, covering engines of the same class working in identical circumstances. An American correspondent recently sent us particulars concerning the U-1a class 4-8-2 express engines of the Central Vermont Railway. Engine No. 603 of this class has just completed 210,000 miles since it was last shopped for heavy repairs, and most of this mileage has been run on the Montreal and Washington trains known as The Washingtonian and The Montrealer. These trains sometimes consist of as many as fifteen steel coaches and Pullman sleepers with six-wheeled bogies. The locomotives were built in 1927 by the American Locomotive Company at Schenectady, New York, and have 26 in. by 28 in. cylinders and 6 ft. 1 in. diameter coupled wheels. The boiler carries a steam pressure of 200 lb. per sq. in. and the engine develops a tractive effort of 44,000 lb. When No. 603 has been returned to service another of the same class, No. 600, which has been taking its place, will go to the shops for heavy overhaul. Other engines of the class have been working between Montreal and Boston, Mass., but the work of No. 603 has been confined to the services named, where, in view of the heavy demands made upon it, its performance both on the road and on maintenance account seems to have been excellent.

The Great Western System of A.T.C.

MANY references have recently been made in the press to the various devices used by railway companies to enhance the safety of the travelling public. Foremost among these in this country is the additional safeguard to the ordinary block telegraph signalling, known as automatic train control, which was introduced experimentally on the Great Western Railway over 25 years ago. After exhaustive trials, this system has been steadily extended until the whole of the Great Western main lines between Paddington, Wolverhampton, Swansea, and Plymouth, totalling 2,130 miles, have been equipped, and 2,500 of its locomotives fitted with train control apparatus. Despite the most foolproof apparatus and methods and the intensive training of the staff, it is imposible to eliminate entirely the risk of accidents arising from the failure of the human element. Moreover, fog or weather conditions are not the only evils to be provided against; experience has shown that even in daylight under the best signalling conditions signals may be missed or misread. The great advantage of this automatic train control system is that it guards against the over-running of signals, as audible warning is given to the enginemen of the position of the distant signals and, in the event of such a signal being passed in the "caution" position, the train is stopped automatically before it reaches the next signal. Although it does not eliminate the risk due to possible errors on the part of signalmen, its value as a safeguard may be realised from the fact that the over-running of signals is the cause of a material proportion of railway accidents.

The apparatus consists essentially of a steel ramp, 40 ft. long, and rising to 3½ in. above rail level, fixed between the running lines opposite the distant signal and connected electrically to the signal lever. When the signal is at "caution" the ramp is dead; the action of pulling the lever to lower the signal, however, completes an electric circuit and energises the ramp. The locomotive is fitted with an iron shoe extending to within 2½ in. of rail level, and as this passes over the ramp it is lifted 1 in. When the signal is at "caution," owing to the ramp being dead, the action of lifting the shoe opens a valve in the vacuum automatic brake apparatus and causes the brakes to be applied throughout the train while, at the same time, a siren is sounded in the engine cab. If the signal is in the "clear" position, the ramp is energised and the electric current, passing through the shoe, prevents interference with the vacuum brake and rings an electric bell in the engine cab.

The essentials of such a system are obviously complete reliability and simplicity of design. As to the former, it will be appreciated that the failure of any portion of the apparatus, either on the locomotive or the track, results in a danger signal being given to the driver and the automatic application of the brake, while simplicity of design, which was so strongly urged by the Cairo International Railway Congress in January, 1933, and the Institution of Railway Signal Engineers in April, 1933, is the outstanding characteristic of the Great Western design. The use of this system, supplementary to the ordinary signalling methods, enhances the already high standard of safety in railway working; facilitates timekeeping, particularly in adverse weather conditions, and assists the general acceleration of both passenger and freight trains. With modern powerful locomotives, heavy loads and fast schedules, enginemen need every assistance that signal engineers can provide, and automatic train control undoubtedly enables them to devote more attention to the manipulation of their engine. Financial considerations must obviously influence decisions as to the installation or extension of any system of this kind on steam lines generally, but, having regard to the substantial advantages to be derived, these should not prove insuperable.

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The L.M.S. Turbine Locomotive

IT has become the fashion when referring to any development of an outstanding character in locomotive practice to label it a "bold experiment." We do not, however, propose to follow this example in dealing with Mr. Stanier's new turbine express engine recently completed at the Crewe works of the L.M.S. Railway; not because of inability to realise that the adoption of this principle of utilising steam for locomotive purposes still remains largely an experiment, and that courage is required in taking such a step at the present juncture. Rather is it for the reason that, having had ample facilities for studying the design and seeing the engine grow up in the Crewe works from the time the frame plates were laid down to that at which the complete locomotive stood ready for painting and testing, we have been able to convince ourselves that in this design every effort has been made to simplify the general layout and follow as closely as circumstances permit what may be termed orthodox locomotive lines. The main and, indeed, the only real difference from a structural point of view is the substitution of turbines and geared transmission mechanism for the more usual reciprocating machinery consisting of cylinders, steam distributing valves, and other motion details. The locomotive closely resembles and is, indeed, identical in several major respects with the 4-6-2 express engines built at Crewe in 1933, *The Princess Royal* and *Princess Elizabeth*, of which class ten more are being constructed to substantially the same design at the present time.

The first question one is inclined to ask oneself in a matter of this sort is why a departure of the kind here involved should be undertaken at all. Turbine locomotives have already been tried out in this country and abroad, more particularly in Sweden, and a great deal of patience and ingenuity expended in the effort to make them show up advantageously in comparison with the reciprocating form of locomotive. Have the results been such as to warrant further trials and experimentation or not? Such a question is natural enough, but the main point for the chief mechanical engineer and other officers of a railway company to decide is whether the theoretical advantages of the turbine can be turned to profitable account on their particular line for dealing with the trains they have to haul under the conditions which actually apply. Once they have satisfied themselves that this can be done the next step is that of plotting a design which, in the judgment of those principally concerned, is the best to meet the circumstances of the individual case. This new locomotive of the L.M.S.R. is designed for an output of 2,000—2,500 h.p.; some of its axles carry a load of 24 tons, an unusually high figure in British practice, and made permissible, of course, by the improved torque of the turbine machinery and consequent elimination of hammer blow. The intention is to use it for hauling through express passenger trains of 500 tons loading or more between London and Glasgow at high average speeds and thus it will be brought into direct comparison with the piston type engines of the same general class. Fuel economy, increased power output and improved balancing, with consequent saving of the track and structures, themselves combine to provide a goal worth aiming at, but there are further advantages which include uniformity of torque when running normally, together with an approximately double torque at starting and the facility to obtain an overload through the medium of the steam nozzles provided for the purpose. The fuel economy expected is 15 per cent., and this, we may assume,

is calculated on a basis of comparison with a compound and not a single-expansion engine; otherwise it might seem to be too low a figure to justify such a definite departure from ordinary practice.

There will, as a matter of course, be criticism of the design of the locomotive apart from the principle on which it operates, and among such criticisms we expect to find one based on the fact that it is of the non-condensing type. It is, we know, urged by some that the absence of condensing apparatus robs the system of half its value. In support of this seemingly exaggerated claim they assert that the incorporation of a condensing system considerably reduces both the coal and water consumption, even to the extent of from 40 to 50 per cent., whilst, further, as the boiler system is a closed one, the quality of the feed water becomes more or less immaterial so far as the life of the boiler and the cost of maintaining it are concerned. All this may be true in respect of certain other types of engines, operating under conditions dissimilar to those of a railway locomotive, and even with the latter in countries where feed water difficulties arise, but in view of the limited space available and the additional complication involved, condensing cannot be urged as a material or necessarily advisable feature here. Mr. Stanier's design is, as we have already inferred, a very straightforward one, closely allied in some measures with the standards already introduced by him on the London Midland & Scottish Railway. There is a good deal to be said in any case, for proceeding by stages, and it must also be borne in mind that, should it later be considered desirable to convert the locomotive to one of the condensing type, this could very well be done, without any great difficulty, by fitting a condensing tender, as has already been done in some other cases.

It remains to be said that careful inspection of the workmanship put into this locomotive and of the manner in which the components have been assembled show that nothing has been left undone either by the manufacturers of the turbines and transmission mechanism, or by the railway works staff to ensure the success of the design in that respect. The boiler is a very fine piece of work in which, in spite of its large proportions, the weight has been kept down as far as is possible by the employment of 2 per cent. nickel steel plate, whilst welding has been resorted to, in conjunction with riveting, at several points. Efficient water circulation will result from the provision of ample water spaces between the tubes and the boiler barrel, and there is also an abundance of steam space above the water level. Well disposed heating surfaces, the provision of a combustion chamber, special front end arrangements, incorporating a double blast pipe with a double chimney, and adequate grate area, are features calculated to ensure efficient boiler performance. The use of roller bearing axleboxes throughout the engine will do much towards reducing rolling resistance and preventing hot boxes. The cab arrangements are excellent and the enginemen are assured of a good lookout on both sides, whilst the controls, gauges, and other fittings are all easy of access. On this point we can speak with emphasis having put the matter to a first hand test. We congratulate Mr. Stanier on his latest achievement, and it is with a feeling of confidence that we predict a measure of success which will justify the enterprising step he has taken in introducing this new type of locomotive which incidentally marks a new stage in the locomotive history of this country by the construction of a turbine locomotive in a railway company's works. A fully illustrated descriptive article will be found on pages 1251-1260 of this issue, accompanied by a folding plate giving detailed drawings of the boiler, turbine machinery, and other principal component parts of the engine.

Paris, Lyons & Mediterranean Railway

ALTHOUGH there was a persistent decline in traffic, results for 1934 improved slightly over those for 1933, because the recent legislative measures in aid of the railways had begun to take effect. Gross receipts fell by fr. 151,385,272 or 4·75 per cent., but in expenses there was a reduction of fr. 282,156,221 or 8·65 per cent., leaving a profit on working of fr. 56,206,755 against a loss of fr. 74,564,194 for the previous year. Capital charges, &c., however, advanced from fr. 836,099,926 in 1933 to fr. 862,503,541 in 1934, and the final result for 1934 is a deficit of fr. 839,170,196, comparing with a deficit of fr. 946,258,495 for 1933. The dividend on each fr. 500 share is fr. 70, the same as in 1932 and 1933, and compares with fr. 80 in 1931, and fr. 85 in 1930. The deficit would have been fr. 1,134 millions had it not been for the legislative measures above mentioned. Reduction of passengers and luggage taxes brought increased receipts of fr. 130 million, and general reductions of wages which came into force on April 20, 1934, cut down expenditure by fr. 65 million and readjustment of the pension system effected a saving of fr. 100 million.

Some railcar developments were described in our Overseas columns on May 24 last, at page 1023. The growth of door-to-door transport was also fully explained on p. 1153 of THE RAILWAY GAZETTE of June 14, 1935. Had it not been for the reduction of passenger taxes, passenger receipts would have been 6·5 per cent. lower instead of showing an increase of fr. 61,647,167 or 8·27 per cent. A further proportionate decline in the use of first and second class carriages was shown in 1934, when the number of passengers per 1,000 was 11 in the first class, 67 in the second and 922 in the third, with receipts per fr. 1,000 of fr. 104 first class, fr. 251 second, and fr. 645 third. The corresponding figures in 1933 were, respectively, 12, 73, and 915 in numbers, and fr. 107, fr. 260, and fr. 633 in receipts. *Petite vitesse* tonnages were down 4 per cent. and receipts 6·7 per cent., the fall in receipts being partly due to reduced tariffs and lower classifications in order to meet road competition. Passenger train-kilometres were reduced 2 per cent., *Messageries* train-kilometres 6 per cent., and *petite vitesse* train-kilometres 3 per cent. The chief decreases in *p.v.* tonnage were in lime and cement 18 per cent., *produits metallurgiques* 13 per cent., building materials 12 per cent., combustible liquids 10 per cent., wines and spirits 7 per cent., and cereals 5 per cent. In small consignments carried under a specially reduced tariff, however, and in consignments of beetroot there were increases of 26 per cent. The accompanying table compares some figures for 1934 and 1933, the present exchange being about 74½ francs to the £ against 76½ a year ago.

	1934	1933
Average kilometres worked	9,949	9,949
Total train-kilometres ..	109,617,037	112,911,092
Passengers	84,723,611	89,150,109
Tons, *p.v.*	30,793,992	32,414,863
Ton-kilometres, *p.v.* ..	7,550,753,984	8,009,312,725
Average haul, *p.v.* ..	245·20 km.	247·09 km.
Operating ratio, per cent.	98·15	102·34
	Francs	Francs
Passenger receipts ..	806,925,226	745,278,059
Other *grande vitesse* ..	514,631,145	551,852,156
Petite vitesse	1,678,763,398	1,856,191,265
Total receipts	3,035,037,043	3,186,422,315
Total expenses	2,978,830,288	3,260,986,509
Profit (+) or loss (−) ..	+ 56,206,755	− 74,564,194

Two new steam locomotives, a diesel-electric shunting locomotive, two loco-tractors, three Bugatti units, 22 railcars and 109 containers were added to stock in 1934,

and during the year orders were placed for one "Bugatti streamline train," two high-speed diesel-electric locomotives, seven loco-tractors, 80 railcars, and 135 containers. The work of fitting all goods vehicles with continuous brakes was nearly finished in 1934, some 57,100 vehicles having been completely fitted at the end of the year. Permanent way renewals during the year amounted to 573 kilometres compared with 554 in 1933. In pursuance of the programme of quadrupling the main lines between Paris and Dijon, work is in hand between Villeneuve-la-Guyard and Sens and between Les Laumes and Blaisy-Bas. In Algeria there has been since November 1, 1933, a joint administration of the company's and the State systems. Certain passenger train services recently abandoned have been replaced by road services. The total deficit for the year on the company's Algerian lines amounted to fr. 60,500,000, against fr. 68,400,000 in 1933.

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Wheel Arrangements and Speed

For the time being the movement in the direction of eight-coupled wheels for express passenger services, in those countries of the world in which the highest speeds are run, appears definitely to be arrested. It is true that speeds up to and slightly exceeding 90 m.p.h. have been attained by eight-coupled locomotives—notably in the recent test of one of the rebuilt 4-8-0 engines of the French Paris-Orleans Railway between Calais and Paris—but various mishaps with 4-8-2 French locomotives have led to a general restriction of speed on all the Mountain type engines in that country. In Canada, at the height of the speed competition between the Canadian National and Canadian Pacific Railways for the Montreal-Toronto traffic, 4-8-4 engines were largely used for the fastest trains, but 4-6-4 engines were subsequently built for these services. Similarly the New York Central lines use 4-6-4 locomotives for all their fast and extremely heavy main line services, and the Pennsylvania relies on Pacific locomotives as the standard type for the principal fast expresses. All the world's fastest records to date with steam have been made with six-coupled locomotives, such as the L.N.E.R. 108 m.p.h., 89·9 m.p.h. averaged for 67 miles on the Chicago, Milwaukee, St. Paul & Pacific RR., 87·5 m.p.h. averaged for 70 miles on the G.W.R., and the latest 118·9 m.p.h. maximum on the German State Railway. And in certain of the latest high speed locomotives of the Milwaukee and the Baltimore & Ohio lines there is a reversion to four-coupled wheels, for both have the 4-4-4 wheel arrangement.

LETTERS TO THE EDITOR

(The Editor is not responsible for the opinions of correspondents)

Railway Maintenance Problems

Edinburgh,
June 12.

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—Your leading article of June 7, since it seems to invite them, is my excuse for submitting a few comments on the article in the same issue dealing with permanent way maintenance. Col. Hull, the author, ascribes rail-joint troubles to the tilting and unequal spacing of the joint sleepers. Unless there is general sinkage of the sleeper, tilting only transfers the rail support from one point to another and cannot be the cause, though possibly to some extent it is the accompaniment, of a low joint. He appears to regard the sleeper as if it were the foundation of a detached column and not, as it is, of a continuous beam.

As for sleeper spacing, his argument runs that impact is due to an irregular curve of rail deflection and this again to uneven sleeper spacing. But the shape of the curve of deflection is also due to the axle spacing. Does he advocate equal axle spacing too and, if it were possible, why should it modify the impact? As soon as a wheel passes the middle of the off-going chair it begins to run downhill; it cannot be "Like a diver running up a spring board," unless Col. Hull asks us to believe that the wheel jumps all the way from the last chair to the end of the next rail. I fear he is one of those for whom the commonplace and simple have little attraction or he would have reflected that if you hit a spike or a key or a joint it shifts, whereas if you push it, it doesn't.

There is, again, his assertion that a long fishplate, as distinct from a short one of the same section, ensures the continuity of the rail strength. Apart from the fact that, as regards British practice, this is physically inaccurate, the only discontinuity of rail section is at the gap and a plate one hundred inches long does no more to bridge this than one of ten. If something other than cross-sectional strength is meant, one may hesitate, failing further definition, to accept a bare assertion, at least with respect to wear or liability to take on a permanent deflection which, after all, is what concerns us.

At the same time it is, perhaps, ungrateful in me to attack your contributor when I owe him my sincere thanks for his sound observation in noting that on a curve where speed and radius were constant, side cutting was as severe on the canted rail as on the part which, owing to local circumstances, had no cant. I hope this unsolicited testimony will be laid to their hearts by all those gentlemen who, despite years of protest by myself and better than I, still instruct us that the more cant the less flange contact.

Yours faithfully,
REGINALD PETERS

The First Train Cruise?

Aguilas (Murcia), Spain.
June 7

TO THE EDITOR OF THE RAILWAY GAZETTE

SIR,—Now that English railways are organising train cruises, it is interesting to recall that over twenty years ago one of the Spanish railways initiated this form of excursion. It is therefore not such a very modern institution as we have been inclined to think. In your issue of April 18, 1913, you recorded the innovation under the heading "A Railway 'Cruise' in Spain" as follows:—

The Madrid-Caceres-Portugal & Western Railway announces an excursion on somewhat novel lines, with the idea of introducing tourists to the little known but interesting country between Madrid and the Portuguese frontier. A special "cruiser" train, consisting of parlour, sleeping, and restaurant cars, will leave Venta de Baños, in connection with the *rapide* from Paris, on May 22, for Leon, Astorga, Salamanca, &c., and at various points along the line, motor cars, carriages, or mules will be provided, with which excursions will be made to places of interest outside the railway zone, rejoining the train, which will thus serve as a sort of travelling hotel, at some other station further along the route. The travellers will in this way be able to visit places quite off the beaten track with the assurance of being able to get back each night to a comfortable dinner and bed in what is practically a private car. The excursion will take 11 days, and the number of passengers will be limited to thirty, who will be required to book before April 25. Tickets may be secured at the Sleeping Car Company's Offices in Paris or London, and the price of the excursion is 775 francs, apart from the railway fares, which—including the journey from Paris and return—will amount to about 300 francs.

Yours faithfully,
GEORGE L. BOAG

PUBLICATIONS RECEIVED

Proceedings of the Institution of Railway Signal Engineers, 1934-35. Part II. Published by M. G. Tweedie (Honorary Secretary), Great Western Signal Works, 80, Caversham Road, Reading, Berks. Price to non-members, 7s. 6d.—Judging by the reports of the work done by this body during the second half of the 1934-35 session, it was a period of exceedingly useful activity. Besides the discussion, initiated by Mr. T. S. Lascelles, on "The Distant Signal Problem," there were three very timely papers, which, together with the discussions upon them, make uncommonly profitable reading. The three papers were respectively "Electrically Controlled Gravity Marshalling Yards," by Mr. F. S. Jackson; "Some Developments in Intermediate Block Signalling," by Mr. S. W. Spendlove; and "Some Applications of Rectifiers to Railway Signalling," by Major L. H. Peter.

Economics of Air Transport in Europe. By Henri Bouché. (League of Nations Publication VIII, Transit 1935, VIII). London: Allen & Unwin Limited, 40, Museum Street, W.C.1. Geneva: Publications Department, League of Nations. 10½ in. × 8¼ in. 74 pp. Illustrated. No price stated.—This is the final edition of the report submitted by M. Henri Bouché, Editor of *L'Aéronautique*, to the special subcommittee of the Organisation for Communications and Transit set up to study the question of the constitution and operation of a main network of permanent air routes in Europe. The author freely admits in his introduction that the information he has gathered together can be regarded as only approximately correct. This was largely due to the difficulty he experienced in obtaining a uniformity of interpretation in the reply to two questionnaires which were sent to the International Air Traffic Association and European Governments. Nevertheless, the report covers the economics of European air transport in a commendably concise and lucid form. The statistics are based on the results for the years 1930-32 inclusive. In addition, however, a section is added showing the evolution of air transport in Europe in 1933. From his examination of the ratios of subsidies and total revenues, M. Bouché states that in the realisation of financial autonomy United Kingdom enterprises have gone nearly two-thirds of the way, the German two-fifths, the French one-fifth, the Italian one-fifteenth, and air transport in Europe as a whole nearly one-third. These results have been obtained in from 10 to 12 years. The cost of the subsidy in 1932 was 14·50 fr. per km., while the receipts from passengers per kilometre were 4·75 fr. Railwaymen should find considerable interest in the remarks on the relative speeds of land and air transport. The position is well summarised by the author who has classified typical surface transport services in decreasing order of speed, and shows that "If we take international connections over distances equal to 700 km. or more, only one of them, Paris–Berlin, provides transport at a speed exceeding 60 km. per hour. I am not sure that there is more than one exceeding 50 km. per hour; several (perhaps five or six) enable a speed of 40 to 50 km. per hour to be maintained over a distance of 700 to 1,050 km. For distances between 1,100 and 2,000 km. the speed falls to 30 to 40 km. The greater part of the connections shown in the 'main network' of your sub-committee show speeds of 26, 21, 17, and even 13 km. per hour. If, therefore, we take a network of through air communications between those terminal points providing a commercial speed of 225 km. per hour, which has today been technically achieved, it is possible by air to save the theoretical time-periods shown in the last column of Table XX. These are some of them: a saving of 9 hr. 15 min. on the route Paris–Berlin (820 km.), of 19 hr. 23 min. Amsterdam–Copenhagen (700 km.), of 36 hr. 40 min. Lwow–Sofia (750 km.), of 60 hr. 13 min. Oslo–Leningrad (1,000 km.), of 126 hr. 13 min. Moscow–Ankara (1,750 km.)."

From these investigations it is concluded that "that part of Europe which is economically the most active will soon be one single territorial district which a fast aircraft will cross in half a day's day-time flying."

Railway Ribaldry. By W. Heath Robinson. London: Great Western Railway, Paddington. 10¼ in. × 7¾ in. 96 pp. Price 1s. net.—Many aspects of railway life are passed over without comment in the standard histories, possibly because their authors know that enlightenment is often disappointing. Mr. Heath Robinson, however, never disappoints. On every one of these 96 pages he improves unerringly upon the truth. He explains, for example, how porters learn to slam the doors of moving trains, how restaurant car attendants acquire the knack of handling crockery at speed, and how engine drivers are taught to observe signals. His methods of imparting such instruction are well known; suffice it to say that he must be a dull reader who does not feel on reaching page 96 that he could start a creditable railway system of his own in the back garden with the aid of a penknife and the contents of the average dust-bin. A strange way, it may be thought, for a great railway to choose of letting the public share in its centenary jubilation. But in our country no gesture could have been better selected to endear it to the public than this of putting itself without reserve in the hands of a great humorist.

Mr. Heath Robinson's fertility of invention is no less impressive than his variety of treatment. With pages of nightmare complexities are mingled vignettes that provoke laughter with a single rapier thrust. "When Coal was Cheap" is a case in point. A diminutive cask stands in the last wagon of a train of empties stretching away to the far horizon, and headed by a locomotive all but invisible amid clouds of steam and smoke.

Sometimes the artist elects to tell a story. A dramatic episode, for example, is presented in "Pulling the Communication Cord in One of the Old Open Carriages." Here an unwanted suitor has by some shameful device secured a seat in the same carriage as his fair quarry. On a lonely stretch of line the wretch makes bold to present her with a posy, but a resourceful chaperone tugs the communication cord and summons the crew of the distant locomotive, who are seen hastening with improvised weapons to avenge this breach of the proprieties.

A foreword to the book expresses the hope that it will be an appreciated contribution to the library of humour. In our view it is a landmark in railway literature, not to be neglected by any collector who wishes his bookshelves to be representative of the ways in which the railways are cementing their cordial relations with the public at the present time.

Compressed Air and Hydraulic Machinery.—We have received from B.E.N. Patents Limited, Gorst Road, Park Royal, N.W.10, a number of catalogues describing the compressed air and hydraulic plant in which the firm specialises. Portable spray painting apparatus is an important item in the range, and is available complete with electrically driven compressors in sizes suitable for a great variety of work and situations. Air compressors are also supplied independently, both with and without motor drive.

Internal Combustion Railway Coaches.—The Drewry Car Co. Ltd., 13, South Place, E.C.2, has been producing railway vehicles of all types propelled by internal combustion engines for the past twenty-eight years, during which time it has been possible to make an exhaustive study of the demands made upon power units and transmission systems by the conditions peculiar to railway service. The fruits of such experience appear in the many illustrations of railcars which are reproduced in this publication. They range from bogie passenger vehicles for high-speed main line service and power goods vans of up to 330 h.p. to inspection cars and light railbuses. The text provides an interesting commentary on the illustrations and makes the book a comprehensive survey of the best in railcar practice. Types of transmission and control equipment developed by the Drewry Car Co. Ltd. are also shown and briefly described. These comprise the Wilson-Drewry pre-selective gearbox, and a patent electro-pneumatic system of control, in which the necessary handles, reduced to a minimum, are grouped on a desk of neat design and can be operated without effort. Interlocking guards against false manipulation by the driver.

THE SCRAP HEAP

Suitcases are now being made of rubber. A railway porter, who dropped one recently, failed to let go and bounced clean out of the station.—*From the "Daily Herald."*

* * *

For 20 years Mr. Harry Lloyd, a textile manager, of Cranbrook Road, Ilford, caught the 7.48 a.m. train to his business in town. Three months ago his fellow-passengers missed him. A few days ago he died, at the age of 78. And at his funeral there was a wreath, inscribed "The 7.48 Train."—*From "The Evening News."*

* * *

Transactions of the Institution of Civil Engineers.—The first volume of this society's transactions has just appeared. It contains several papers and communications of considerable interest, by distinguished members of the profession, some of them written very well.—*From "The Railway Magazine" of February*, 1837.

* * *

AN ARGENTINE PICTURE MAP

The pictorial map is an advertising fashion which has spread to other countries besides our own. We reproduce a specimen from Argentina, setting forth the pleasures of tourist travel on the State Railways. When opened it measures 13½ in. square, but folds up to the handy size of 6¾ in. × 5 in. for carrying in the pocket. Much useful information regarding cheap tickets appears on the back, as well as an almost lyrical description of the benefits of a change of air and scene. Such rhetoric as, "travel instructs the mind, delights the heart, and fortifies the body," serves as a prelude to particulars of how these benefits may be derived at very reasonable charges.

The map itself is designed to show the regions for which the Argentine State Railways issue unlimited travel tickets with a two-months availability. These cost $100 for individual travellers, but only $70 a head for parties of schoolchildren accompanied by their teachers. Books of tickets can also be bought, but the applicant is warned that "it is essential to submit two photographs, measuring 3½ cm. × 3½ cm." If liable to be saddled with one patron for long periods, the State Railways no doubt feel they have a right to know what to expect. Nor do their requirements seem excessive; however low modesty may compel us to assess our personal attractions, we all cherish the idea that our physiognomy would at least pass muster in a space three and a half centimetres square.

Local pursuits and recreations are the principal theme of the map. Santa Fé for example, catches the eye with its outsize in agricultural machinery and a bale of cotton wool, while in the bottom left hand corner the alcoholic industries of San Juan are typified by various groups portrayed bottle in hand and beatific of countenance. In Santiago del Estero the centre piece is a rustic dance, watched by a semi-circle of natives squatting upon the ground, a pastime for which they seem as well adapted anatomically as they are, no doubt, by temperament, due to the equability of the climate.

The State Railway system is clearly indicated on the map, with here and there a train bursting through a territorial boundary represented by a wooden fence. Other railway pictures appear on the reverse side, including humorous treatment of animated scenes at a station and *en route*. We are also shown the unfortunate division of a family caused by one of its members having discovered a maiden conveniently situated a stone's-throw from the station, and paying his addresses while the saner elements are left to guard the luggage. But the episode can be dismissed as no more than a pleasant frivolity, for an adjacent paragraph assures the reader that, far from fostering a flightiness of disposition, "travel inspires in the tourist a profound and healthy pleasure, tempered with ennobling sentiments . . . . ."

"RAILWAY" INN SIGNS

The relative paucity of inns named after railway subjects has been commented upon by several correspondents in *The Daily Telegraph* recently, and the suggested reason is that most taverns were established well before the days of mechanical transport. It would almost seem that when human inventiveness began to evolve machinery it became sterile in the matter of nomenclature, for the multiplicity of "Railway Hotels" is a striking contrast to the diverse titles suggested by other branches of daily activity. Here and there, however, a name has been borrowed from the railway, and its various accessories. Among the signs quoted in the correspondence have been an "Engineer's Arms" at Harpenden and Stratford, the former probably dating from the construction of the Midland Railway route to London and the other doubtless inspired by the nearby works of the G.E.R. It is not surprising to find "The Locomotive" at Camden Town, and the name also occurs at Exeter. Luton enters the list with "The Engine." A Norfolk landlord seems to have wished to display a more intimate knowledge of engineering by calling his inn "The Safety Valve." Other departments of railway activity are represented by "The Railway Telegraph" and "The Railway Signal," both at Forest Hill.

A picture map of the tourist centres served by the Argentine State Railways. It is issued as a pocket folder, and includes much useful information relating to cheap fares

OVERSEAS RAILWAY AFFAIRS

(*From our special correspondents*)

ARGENTINA

Opening of Congress: The Presidential Message

The 1935 session of the Argentine Congress was opened on May 15 by the President, and the public works section of the presidential message was devoted mainly to a review of railway affairs. The message mentioned that, although the financial situation of the railways continued to be serious, it was satisfactory to announce that during 1934 a slight improvement was noticeable. The gross receipts had increased from $178,482,565 gold in 1933 to $191,815,478 gold in 1934, and expenses had been reduced from $145,471,345 gold to $140,440,056 gold. The net receipts amounted to $51,375,422 gold, as compared with $33,011,220 gold in 1933, and $42,886,850 gold in 1932. The decline in passenger receipts continued, however, 136,012,760 passengers having been carried in 1934, as compared with 137,748,253 in 1933, and 146,906,442 in 1932. The improvement shown was therefore in goods traffic, which had risen from 34,623,274 tons in 1933 to 36,269,352 tons in 1934. This improvement in the receipts had led the employees to press for a restoration of the wage-cuts imposed in 1932 and 1933, and as the companies and the unions had failed to reach an agreement the question was submitted to the President of the Republic whose decision had been accepted by both parties.

The message further stated that despite the financial difficulties with which the companies were confronted, 796 new works, at an aggregate cost of $9,181,891 paper had been carried out during the period under review, and 427 other schemes, involving an expenditure of $19,410,765 paper, were in course of execution. Most of these were for the State Railways. The operation of all the railways had proceeded normally, with the exception of the Argentine section of the Transandine Railway, the working of which had been suspended owing to a large portion of the track having been destroyed by the avalanche and floods which occurred in January, 1934. Since August last a provisional motor-car service had been successfully operated between Mendoza and Punta de Vacas.

The State Railways

The message went on to state that the past year had been a very favourable one for the State Railways, the receipts having increased by some 10 per cent. As expenditure had been reduced by about half a million paper dollars, the result was a net surplus of some $8,000,000 paper, or nearly four times as much as that registered in 1933. This improvement in the financial situation had made it possible to restore the salary and wage cuts imposed in 1932. The following table shows the comparative working results of each of the State-owned lines for the years 1933 and 1934:—

	1934 $ Paper	1933 $ Paper	Inc. or Dec. $ Paper
C.N. Argentine	48,721,256	44,015,773	+4,705,483
F.C. del Este	1,196,761	853,214	+ 343,547
Viedma to Nahuel Huapi	2,137,150	1,603,948	+ 533,201
Chubut ..	421,257	483,143	− 61,886
Comodoro Rivadavia..	420,000	392,268	+ 27,732
Puerto Deseado ..	276,912	273,240	+ 3,673
	53,173,336	47,621,586	+5,551,750

Construction of Grain Elevators

The Agricultural section of the Presidential message announced that, as foreshadowed in THE RAILWAY GAZETTE of February 15 last, tenders would shortly be invited for the construction of a chain of national grain elevators, comprising 12 terminal elevators with a joint capacity of 650,000 tons and 445 subsidiary elevators with an aggregate of 725,000 tons. It was estimated that the proposed elevators would be sufficient to handle approximately 10,000,000 tons of grain, and that the exchange profits would be utilised for the financing of the scheme instead of this being effected, as originally intended, by means of a bond issue.

Jubilee Luncheon of Chamber of Commerce

At a luncheon given by the British Chamber of Commerce in Buenos Aires on May 8 in celebration of the King's Silver Jubilee, the two specially-invited guests were the British Ambassador, the Rt. Hon. Sir Henry Chilton, G.C.M.G., and Mr. J. M. Eddy, C.B.E., a Director of the B.A.G.S. and B.A.W. Railways. In proposing Mr. Eddy's health, the Chairman, Major W. A. McCallum, said that Mr. Eddy had come out to uphold the views of the railway shareholders—a long-suffering and very numerous body—and to ask, as indeed that body had good reason to ask, if it was quite fair that their investments should be debarred from sharing in Argentina's returning prosperity, largely owing—as the committee appointed by the Government had admitted in its recent report—to burdensome and antiquated regulations. In his reply, Mr. Eddy referred to the efforts which the British Government was making to reconcile the conflicting interests involved in a settlement of the problem of foreign meat imports, and said that although the case of those who advocated the putting of home products first and Empire products next merited sympathy, there were other interests which deserved consideration. The case for the great body of people who had ventured their savings in undertakings of all kinds in foreign lands, had not been given the prominence and support it merited, and in whatever readjustment our actual policy might demand, those interests had a right to be borne in mind.

Institution of Mechanical Engineers (River Plate Branch)

By the courtesy of the management of the B.A.G.S. Railway, the members of the above branch travelled to Bahia Blanca on May 16 to inspect the company's grain elevators at Ingeniero White and Puerto Galvan. The engineer-in-charge, Mr. D. C. Bruce, A.M.Inst.Mech. E., read a paper on the construction and working of the elevators, and afterwards conducted the party over the plants at both places.

INDIA

Revision of Goods Classification

In the absence on leave of Mr. Jarrad, Mr. Venables, Agent of the East Indian Railway, is presiding over the sub-committee of the Indian Railway Conference Association, charged with framing proposals for the simplification or revision of the classification of goods. Mr. Venables recently explained to the Calcutta Advisory Committee of his railway the objects of the investigation and requested the members to assist the committee with suggestions for improvements which would serve both commercial and railway interests. On the invitation of Mr. Manley, Agent, the Eastern Bengal Railway Local Advisory Committee appointed a sub-committee to recommend measures of revision of the goods classification which would assist the commercial communities. These steps are in accord with the assurance given by the authorities that commercial opinion would be given full consideration before the proposed revision was made operative.

VICTORIA

Tour Report of the Chairman of Commissioners

In the report upon his recent world tour, Mr. Clapp, Chairman of the Commissioners, stresses his conviction that the greatest advance in modern railway traffic building is the air-conditioning of trains. He considers it an indispensable part of modern railway equipment that has improved the attractiveness of passenger travel by rail in North America to an extent scarcely credited elsewhere. Two air-conditioning sets have been ordered for Victoria for staff instruction purposes, prior to the complete equipment of certain long-distance trains as early as possible.

Regarding Diesel Traction

Diesel sets as used on the high-speed streamlined trains in the U.S.A., are,

Mr. Clapp considers, far too costly in outlay and no data of maintenance charges are yet available. For Victoria he recommends British-built diesel sets of the Danish type, which have already proved their suitability and reliability. The Victorian Government has accordingly approved the purchase of two such sets. Super-speeds and lightweight trains as used in America, he also considers unsuitable where there are many open crossings and stations with complicated trackwork at frequent intervals. Long-distance trains substantially constructed of alloy-steel and hauled by streamlined steam locomotives are likely to become standardised, according to Mr. Clapp. Cor-ten (chromium-copper-silicon steel of low-carbon content) has immense potentialities for rolling stock.

Locomotive and Rolling Stock Practice

He is satisfied that locomotive research in Victoria has produced results that are very much in line with the latest modern practice on progressive systems overseas, notably that following the work of Dr. Wagner. Overhaul of electric rolling stock at the Acton works of London Transport may be taken as second to none and accepted as a model elsewhere. Electric welding and X-ray examination of welds were being increasingly used in all directions, Mr. Clapp found.

GERMANY

Restriction of Electrification

The Minister of Transport, Baron von Eltz-Rübenach, in addressing members of the V.D.I. (Association of German Engineers) at Breslau, stated that further electrification of Reichsbahn lines would progress but slowly, owing to the difficulty of financing such schemes and also in consideration of possible repercussions on the labour situation. Information from other sources indicates that electrification on a large scale will not go beyond the Munich–Berlin section for the time being, and that minor schemes will affect suburban connections only. Baron von Eltz-Rübenach also announced that, while there had been some hesitation in regard to extending widely the use of railcars with internal-combustion engines, this hesitation was now disappearing, as there was reason to believe that at the end of the 15-year plan now in force, either there would be no more foreign exchange difficulty, or the problem of indigenous fuels would have been solved in a satisfactory manner.

Fruit and Vegetable Express Trains

The Reichsbahn has introduced fast goods trains running at speeds up to 90 km.p.h. (56 m.p.h.) to carry early fruit and vegetables from the climatically favoured southern parts of Germany to the main consumers' districts. A train leaving Buhl (south of Karlsruhe) at 4 p.m. is due in Berlin (Anhalter) at 4 a.m. next morning, thus enabling Berlin households to serve the goods in perfectly fresh condition at noon on the same day.

SPAIN

The Northern Railway in 1934

At the annual general meeting of the Northern of Spain Company, recently held in Madrid, it was resolved that although no dividend was earned from traffic receipts, a distribution of ten pesetas per share should be made out of the company's invested reserves. As regards the results of working for 1934, gross earnings were 349,089,129 pesetas or 12,096,897 more than in 1933. Working expenditure was 265,476,862 pesetas or 7,259,137 higher than the previous year. After providing for fixed charges and pensions, the result is a net loss of 9,402,096 pesetas, less by 4,064,758 pesetas than the loss of the previous year. The Managing Director, Señor Bravo, referred in his speech to the disastrous effects of the revolt of October, on the traffic of the company, which made a difference of 33,080 fewer wagons loaded.

The Andalucès Company in 1934

This company has just held its annual general meeting, when the accounts were presented showing 53·16 millions of pesetas gross earnings against 52·34 millions in 1933. Working expenses were reduced to 54·70 millions from 57·88 millions in the previous year, the working ratio being 102·90 per cent. as against 110·57 per cent. in 1933. The loss on working of 1·52 millions, added to the fixed charges makes a total loss on the year of 12·06 millions against 16·47 millions in the previous year.

The National Western of Spain in 1934

The annual general meeting has just been held in Madrid, when the accounts were presented showing a working loss of 5·11 millions of pesetas. The losses on this regrouped system to be covered by the State have been as follow: 1929, 2·47 millions; 1930, 0·96 millions; 1931, 2·74 millions; 1932, 3·72 millions; and 1933, 6·90 millions.

Motor Competition

A protest presented by the Madrid Chamber of Commerce to the Minister of Finance throws light upon a new phase of the activities of the owners of "pirate" lorries. It appears that these vehicles are now competing not only with the railways in the transport of goods, but also with the shop keepers and other interests engaged in the legitimate business of distribution. Lorries load up in the central markets and proceed along the country roads and through towns and villages, selling their merchandise wholesale or retail to the public, without paying rates or vendors' licences. It is expected that this and other abuses constantly committed by the "pirate" lorries will be punished or corrected when the inspectors nominated by the railway companies are authorised by the Finance Ministry to inspect the lorries and denounce legal infractions, especially as a proportion of all the fines levied is to be retained by the inspector discovering the fraud.

Railcars

According to the Madrid journal "*El Financiero*" a company is being formed in Madrid with the object of financing the supply and operation of railcars for the Spanish railways. The board of the new company will represent the two principal companies, Norte and Madrid, Saragossa and Alicante, and capital interests will be represented by nominees of six of the principal banks. The nominal capital is to be fixed at ten millions of pesetas. Señor Bravo, of the Northern company, will be the Chairman of Directors, and the Madrid Saragossa and Alicante Company will be represented by Señores Vives and Santiago, the latter, who is the Deputy Chief Mechanical Engineer of the M.Z.A. Company, being the author and promoter of the scheme. The Managing Director of the new company is to be Señor Don Manuel Soto Redondo, the present General Manager of the Union Naval de Levante Company. It is said that the new company will undertake the supply at once of 18 new railcars for the Northern Railway and also an important order for the M.Z.A., and the construction will probably be entrusted to the Spanish firms of Carde & Escoriaza, of Saragossa, the Beasain Company, and the Sociedad Española de Construccion Naval.

FRANCE

Railcars to Replace Steam Trains

One of the main difficulties of the financial situation in France is the railway deficit, and the Government plans will include steps to deal with it. Although at the time of writing nothing definite is known, it is a fairly certain forecast that a strict application of some of the co-ordination measures proposed in the law of 1933 will be made as early as possible. Substitution of railcars for steam trains throughout the country on lines where traffic is light is likely to be enforced without waiting for the general adoption of the local rail and road co-ordination agreements, which comprise provisions to this effect.

This extension of railcar services is all the more probable because M. Raoul Dautry, General Manager of the State Railways, is one of the experts appointed to advise the Government on economic and financial matters, [vide our Personal columns last week.—Ed.]. The interest shown in railcars by M. Dautry is well known. Some days ago he organised an exhibition of railcars at the St. Lazare terminus to give members of the Conseil Supérieur des Chemins de fer an opportunity of inspecting the principal types. Prior to seeing the cars the council had discussed a report presented by M. Labbé, a specialist of the Ministry of Finance, who pointed out the interesting results and substantial savings made

by the use of railcars on the French railways.

ITALY

An Invaluable Consignment

What is probably the most valuable railway consignment ever booked was despatched about the middle of April from Florence to Paris. There have been consignments of gold the actual value of which may have been greater. But gold is replaceable, whereas the consignment in question comprised four vans containing the greatest Italian masterpieces, which the Italian Government has sent to Paris for the Italian Art Exhibition which is even more extensive than the famous display at Burlington House a few years ago. The market value of the paintings runs into millions of pounds and the most extraordinary precautions were taken during the whole journey. To ensure that the continuous rhythmic vibration of the train should in no way damage the invaluable wooden panels or canvasses, the pictures were placed on specially constructed floors in the vans consisting of stout plywood layers with compensating springs between them. Similarly the sides of the vans were heavily padded. A squad of the Railway Militia accompanied the train, which was relieved at Modane by a special detachment of the French State Police.

CHINA

Kowloon-Canton Railway

The winter passenger and mixed train service since October last has consisted of 15 trains each way into and out of Kowloon. Of these 30 trains, six are through passenger, two through mixed, 18 local passenger, and two local mixed each way. The summer total is 13 each way, and in both seasons all are steam-hauled except two " motor trains " available for first class passengers only. The time of the fastest trains between Canton and Kowloon has been reduced to 2 hr. 57 min. for the 111 miles of single line. There are three intermediate stops and 19 tablets have to be picked up by hand *en route*. The locomotives used for this service are 4-6-0's with 6-ft. driving wheels, 21 in. by 28 in. cylinders, and 18½-ton axle loading. Since October 1 last the service has included a midday fast train each way, which takes 3 hr. 45 min. with eight intermediate stops. These trains are worked by 2-6-4 tank engines. Additional 6,000-gallon tanks are run to supplement the water capacity of these tank engines, and loads are limited to eight coaches. Eight of the ten through trains between Canton and Kowloon are worked by British Section engines, although only 22 miles of the 111 form the British Section. The train density works out to two train-miles per mile of running track per operating hour, a high figure for single-line working. The locomotives are now classed as follow :— " A " class 2-6-4 tank, " B " class 4-6-4 tank, and " C " class 4-6-0 express passenger locomotives.

Very heavy traffic was handled during the Jubilee period. On Sunday, May 5, five expresses, hauled by 4-6-0 locomotives, and two other fast trains, hauled by 2-6-4 tank engines with additional tankage, carried over 10,000 passengers. The Flying Eagle, consisting of 13 coaches, carried 1,727 and two other expresses, with 12 and 9 coaches respectively, carried 1,736 and 1,166 passengers. But the record attained was with the 12-coach Flying Dragon express, in which were packed no fewer than 2,237 passengers.

ERITREA

Improved Communications

The limited capacity of the railway from Massauah to Asmara, the capital, has induced the Government to construct an aerial ropeway 21 km. (13 miles) in length from Goadif, near Asmara, to Ghinda, a station some distance down the line, which is connected by a good road with the port of Massauah. The ropeway will have a capacity of 30 tons an hour, its cast-steel carriers will each carry 300 kg., and there will be 500 carriers in continuous movement. The ropeway is built on the " jig-back " system, and will be electrically driven, power being supplied by a diesel generating set. The railway line from Massauah to Asmara is single and its capacity is further limited by very heavy gradients—the ruling grade being 1 in 26—and by sharp curves many of which have a radius of 3½ ch. The distance from Massauah to Asmara is 122 km. (76 miles), and the line rises to an altitude of 7,874 ft. above sea level. The whole line has recently undergone great improvement, the track has been strengthened, and railcars have been put in service.

MANCHUKUO

South Manchuria Railway Prosperity

Very remarkable figures and high records in S.M.R. receipts are reported for the year ended March 31, 1935. The total earned was Y. 147,000,000, including Y. 15,900,000 for harbours, &c. Of the purely railway receipts, those for passengers, for goods, and the total were all the highest ever recorded since the line was established in 1907. The increases, as compared with the previous year, are also remarkable :—

	1934 Y.	Increase Y.
Passengers	21,036,730	2,279,356
Goods	104,595,087	20,332,068

C.E.R.-N.M.R. Transfer

As a result of journeys made on the North Manchuria sections (the late Chinese Eastern railway) since the transfer from Russian to Manchukuo management, it appears that on all sections the transfer has been effected smoothly and without a hitch, and no untoward incidents have been reported. The former Russian station and train staffs have been entirely replaced by Japanese, and since the transfer the Japanese staff has been considerably increased on the principal stations and on the trains. Russians have been retained in various departments at the Harbin head offices, now divisional offices, in the workshops and in the permanent way departments. Passenger fares have been reduced to the standard rates of the State Railways and the South Manchuria Railway, and the supplement for a reserved seat has been abolished. Fourth class has been abolished, and the carriages, all four-wheeled, are being rebuilt as third class or closed goods vans.

Trains were overcrowded during the first few weeks, but additional trains are now running on all sections, and the running of night trains has been resumed. Freight rates have been revised and brought down to the State Railway standard, but in some cases there has been an increase in these rates, and they are now being examined to meet the requests of the traders concerned.

Drivers Unused to Russian Engines

The Japanese had difficulties in adapting themselves to the new surroundings, especially the engine crews. Serious unpunctuality in the train working and a good many collisions, some with fatal results, were recorded in the first month. The Japanese crews are used to engines which have a large margin of power in hand for the trains they are required to move, whereas the Russian engines have none to spare, hence the loss of time, and the cases of engines getting out of control. The weights of the trains behind the tenders are being reduced and additional trains will be run if the traffic demands it.

Anti-Bandit Measures

As bandits have shown increased activities lately, particularly on the Hsinking-Tumen line, the State Railways management has decided to increase the Manchukuo and Japanese railway police forces stationed along that line. The police guards on all trains will be provided with hand grenades, machine guns and wireless equipment, and those along the line will have police dogs and carrier pigeons. During the regularly recurring periods of bandit troubles it is customary to run a pilot engine with a car load of soldiers a few minutes in advance of the train; sometimes armoured trains are provided for this purpose. For the time being these measures are being extended to all trains on this line.

State Railway Results in 1934-35

The earnings of the Manchukuo State Railways during the 1934-1935 fiscal year reached the record figure of Y84,000,000.

IMPRESSIONS OF OVERSEAS TRANSPORT

XXI—The South Australian and Western Australian Railways

By A. W. ARTHURTON, formerly Secretary, British Railways Press Bureau

THE States of South Australia and Western Australia are so huge in extent that, with the Central and Northern Territories, they cover considerably more than half the continent. The population, however, except in the southern portions, is very thinly scattered over very wide areas, and the railways form only about one quarter of the total rail mileage of Australia. In the north, sheep and cattle stations of a million acres and more in extent are to be met with, and the bulk of the population clusters in the south and south-west corners of these vast States, a network of lines radiating from the capital cities of Adelaide and Perth to meet their needs.

When travelling in Australia, ideas of distance have to be adjusted. From east to west (Brisbane to Perth), for instance, is 3,400 miles, which takes six days and nights by train. Here distance is reckoned by time, not by mileage, and the time varies with the method of transport available. The thousand miles from Port Augusta on the South Australian Railways to the railhead at Alice Springs, takes three or four days by train, but the next thousand miles across the desert of Central Australia by camel or motorcar to Daly Waters or Birdun, the present terminus of the railway which runs south from Darwin, may take as many weeks. To South Australia belongs the honour of building the first State-owned railway in the British Empire. Today it possesses an aggregate length of 2,529 miles (1,078 miles 5 ft. 3 in. and 1,451 miles 3 ft. 6 in. gauge) the average cost per mile of which was £10,983. There is one mile of railway for every 231 people.

The recent complete rehabilitation of the railways has given South Australia an efficient and up to date system capable of handling expeditiously the merchandise and primary produce of the State. A progressive railway construction policy has been an important factor in promoting prosperity, as many of the lines built have been for developmental purposes. This, it is pointed out, is a heavy burden on the railways, which are charged with the full cost of such lines, but the latter, although not commercially justified, have had the effect of developing formerly uninhabited land and of bringing in large revenues to the State in the shape of proceeds of sale of land, rent, taxation, and so on.

I gathered from Mr. Anderson, the Commissioner for Railways, that railway operations are still reflecting the prolonged world-wide economic depression, and that the main cause of the reduction in earnings last year was the fact that, owing to the extremely low prices offering for wheat overseas, a large proportion of the wheat harvest was not railed to the seaboard. This factor appears to be still operating, as I noticed that at almost every wayside station hundreds of bags of wheat were stacked awaiting orders for disposal. Mr. Anderson, however, was very optimistic as to the future of railway transport in Australia. Adjustments and developments in railway traction in South Australia are constantly taking place, and the question of utilising the latest type of high-speed diesel engines as power units on railcars is receiving close attention. An order has been placed for a 5-h.p. diesel engine to be used in one of the " 55 " type railcars, and at the Islington locomotive works one of the 180-h.p. Winton engines used for the " 75 " type railcar is being converted into a diesel engine of approximately 200 h.p.

Adelaide, the capital of South Australia, is a veritable garden city, with broad streets and bungalow-like villas. Surrounding the whole city is a belt of parkland some 2,000 acres in extent, beyond which lie vineyards, orange groves, olive plantations and orchards. The new Adelaide railway station is a striking addition to the architecture of the city. It provides accommodation for the whole of the Commissioner's administrative staff and every modern facility and convenience for the travelling public. Another item in the rehabilitation scheme has been the complete remodelling of the Islington railway workshops, covering an area of 15 acres and equipped with the most modern machinery for the manufacture and repair of locomotives and rolling stock.

Western Australia has suffered in the past from the widely-held belief that climatic and soil conditions were such that agricultural pursuits over very large areas would be impossible. The propaganda of the railways in recent years has broken down this belief, and the tourist possibilities of the south and south-west are being fully exploited. The Government Tourist Bureau has taken advantage of the network of railways which covers these portions of the State to arrange a series of special round railway tours from Perth embracing the whole of the tourist resorts. Special tickets are issued which enable the holder to make these circular tours and break his journey at various points *en route*.

The water supply for railway purposes in countries like this is one of the most important factors of railway working. Water for locomotives is stored in railway reservoirs and millions of gallons have to be hauled by train each year. The railways also possess a distilling plant, but millions of gallons of water are taken annually from the Mundaring reservoir, which was built mainly to supply Kalgoorlie with fresh water. Water used to be 2s. a gallon in Kalgoorlie. Today there are plenty of swimming baths and well-watered public gardens. The Mundaring weir scheme, by which a daily supply of four million gallons of water is brought from near Perth, 350 miles distant, is one of the most romantic engineering feats in the world. The great pipe through which the water flows runs alongside the railway all the way to Perth. There are eight pumping stations, which lift the water no less than 1,210 ft. *en route*, and it travels in the pipe for four weeks before reaching the goldfields, the total length of the mains being 1,519 miles. The scheme cost £4,000,000.

Western Australia is the gold mining State of the Commonwealth. So much is heard of Kalgoorlie, Boulder, and the famous Golden Mile, from which millions of tons of ore and millions of ounces of gold have been taken, that I was glad to have an opportunity of seeing the goldfield during an enforced wait of three hours on a journey across the continent. Hotels are thick in Kalgoorlie, and apparently absorb most of the money made by the miners, but as we went up Hannan Street the prospect of the Golden Mile was not impressive. It looked more like a battlefield in Flanders, the ground torn and gashed by workings in all directions. Our taxi-driver said that a six weeks' strike of miners had just ended, and pointed to burnt-out hotels and dwellings destroyed in the riots twelve months earlier, when a miner having been accidentally killed by an Italian, the whole town rose up, defied the police and sacked the foreigners' quarter.

OUR CENTENARY—MESSAGES FROM READERS

As announced in our May 3 issue, "The Railway Gazette" and the journals incorporated with it have completed 100 years of continuous publication

THE following is the eighth instalment of the many messages we have received in connection with the centenary of THE RAILWAY GAZETTE and the various railway journals now incorporated with it, the earliest of which made its first appearance on May 1, 1835. In expressing our thanks to all who have written, may we say how greatly we value their appreciative and encouraging messages.

Mr. D. R. Yates, O.B.E., Chief Mechanical Engineer, Iraq Railways.

I consider the contents of your paper are excellent and as useful as possible in the form and proportions as now published.

Mr. E. S. Brittenden, District Traffic Manager, New Zealand Government Railways, Christchurch.

My heartiest congratulations to our good friend THE RAILWAY GAZETTE on the attainment of its century ; may it long continue to function. I find your editorials and articles on road competition, rolling stock, and diesel traction most useful, and your notes and news column and special articles (such as those by Mr. Arthurton) most interesting.

Mr. Ulrich Fuhrmeister, Fuhrmeister & Co., Shanghai.

It was with great pleasure that I learned that your journal is celebrating its 100th birthday. For eight years your former journal, *The Railway Engineer*, was the most interesting guide through railway life to me, and by its thoroughly selected articles I was kept well informed about all innovations of international railways. Since its recent amalgamation with THE RAILWAY GAZETTE I find that the latter journal is even more substantial as concerns reports and articles about railway matters all over the world. I have tried in several countries of Europe, and also in U.S.A., to find out good and interesting journals dealing with railway matters ; however, I did not find one which I could compare with your journal.

I must highly acknowledge the efficiency of your journal, which combines thoroughness of its reports with a remarkable variety of the matters. I cannot but express my highest esteem to the achievements of your journal, which in my experience is the only paper which should completely satisfy its readers in any part of the world since it does not neglect railway progress and history in any country. There is not one feature in your journal which I should like to miss, though I must admit that first of all I look through the Overseas Railway Affairs and next to this through the Notes and News, since these give in brief form the most interesting short reports on the development of international railway life.

My very best wishes accompany your journal into its second centenary, which I hope will bring further progress and a good expansion among those readers who are keen on first-class articles and reports of railway matters as exclusively contained in THE RAILWAY GAZETTE.

Mr. Raymond Richardson, New South Wales Government Railways, Redfern, Australia.

It is a great pleasure for me to extend to you congratulations on the occasion of the 100th year of continuous publication of THE RAILWAY GAZETTE, and the journals now incorporated with it, and I wish every success for the journal in the future.

THE RAILWAY GAZETTE and the journals now incorporated with it have played an important part in the development of the railways of the world ; for instance, THE RAILWAY GAZETTE provides the source of information regarding railway developments overseas for the Australian railway engineers. Also, the journal provides a reliable and useful reference for future use.

At present, THE RAILWAY GAZETTE is received in Sydney from five to six weeks after the date of publication in London. Shortly, when the air mail comes into general use and air mail postage rates are reduced, the journal should be in readers' hands in Australia within two weeks from the date of publication. The features of the paper that are most interesting and useful to me are those in connection with steam locomotive design, construction, and maintenance.

Mr. P. C. Cheng, Traffic Manager, Chinese National Railways, Shanghai.

Regarding the centenary of the publication of THE RAILWAY GAZETTE and the journals incorporated with it, I have great pleasure in tendering you my hearty congratulations and sincere wishes on this auspicious occasion. That these distinguished journals have proved to be of immeasurable value to those engaged in or connected with railway engineering and transport in the last century is a matter of general recognition. Their continuous publication over such a long period of time not only reflects great credit on their publishers, but eloquently testifies to their indispensability to railroadmen in all parts of the world. The celebration of their centenary is, therefore, an event not only to be rejoiced at by their publishers, but by their world-wide readers as well.

Among the multifarious features contained in these journals, I may say that the editorials, the overseas railway affairs, and the monthly railway statistics are of particular interest to readers in this country. If, in my opinion, the scope of the latter two items can be enlarged to include more articles on train operation and other comprehensive statistical data of different countries, they will undoubtedly become even more useful and instructive to their overseas readers. Meanwhile, the insertion of more illustration of railroad improvements in different countries would not fail to stimulate additional interest.

Mr. W. Krahenbuhl, Chief Engineer, Sulzer Bros. (London) Ltd.

We have been asked by Sulzer Brothers, of Winterthur, to communicate with you as follows :—

We see with interest that THE RAILWAY GAZETTE has completed 100 years of publication. This is indeed a notable occurrence, especially in the case of a technical paper. We would take this opportunity of mentioning that THE RAILWAY GAZETTE is much appreciated by us. It is read with interest by many members of our staff, owing to its instructive contents and the fact that it is always up to date. We are pleased to offer you our congratulations, and hope that the success which THE RAILWAY GAZETTE has hitherto enjoyed will continue to increase in the future.

We should also like to associate our congratulations with those of our friends in Winterthur.

M. Henry Pollet, Zurich, Switzerland.

On the occasion of the centenary of THE RAILWAY GAZETTE hundreds of congratulatory messages have reached you. May I, too, add my modest homage, although but one of your newest readers (it is, in fact, only since November 30, 1934, that I have been able to appreciate the high value of this unique journal). As long as there are railways, THE RAILWAY GAZETTE will uphold its high tradition of impartial information on all questions relating to the vast railway domain. The technical articles and the news items interest me most, and the amalgamation of *The Railway Engineer* with your review seems to me a worthy centenary gift to THE RAILWAY GAZETTE.

The special numbers and the supplements are excellent. In Switzerland railway electrification is a national task ; it is therefore very helpful to learn, through the *Electric Traction Supplement*, about conditions and achievements in other lands. The *Diesel Traction Supplement*, excellent alike in text and illustration, gives information on a form of traction whose possibilities grow ever clearer. In like manner, the steam locomotive has been improved to a point when one might consider a *Steam Traction Supplement*.

BRITISH RAILWAY STATISTICS

"The Railway Gazette" monthly table of freight and passenger traffic figures for March, 1935, as compared with the corresponding period in 1934, compiled from the Ministry of Transport Statement No. 184

Description	Great Britain*	Great Western	London & North Eastern	London Midland & Scottish	Southern
PASSENGER TRAIN TRAFFIC—					
Number of passenger journeys (excluding season ticket holders)	95,356,650	6,690,763	13,455,649	22,027,693	16,361,948
Increase (+) or decrease (−)	− 309,911	− 286,307	− 33,985	− 608,350	− 327,194
Passenger receipts (excluding season ticket holders)	£3,187,835	£398,746	£618,811	£966,203	£683,525
Increase (+) or decrease (−)	− £575,594	− £110,079	− £106,749	− £216,527	− £133,353
Season ticket receipts	£779,143	£46,623	£131,523	£202,448	£253,025
Increase (+) or decrease (−)	+ £60,482	+ £985	+ £1,328	+ £12,506	+ £23,961
Parcels and miscellaneous traffic receipts (excluding parcels post)	£1,049,150	£194,446	£313,311	£396,890	£125,734
Increase (+) or decrease (−)	− £60,958	− £10,031	− £15,578	− £16,373	− £10,617
FREIGHT TRAIN TRAFFIC—					
Freight traffic (tons) (excluding free-hauled)	22,026,903	5,168,626	10,000,744	10,464,332	1,396,739
Increase (+) or decrease (−)	− 646,770	− 140,874	− 98,366	− 205,316	− 100,126
Net ton-miles (excluding free-hauled)	1,241,407,942	228,291,605	411,890,372	508,974,557	56,833,404
Increase (+) or decrease (−)	− 34,679,567	− 1,696,395	− 19,785,449	− 7,902,245	− 4,321,906
Average length of haul (miles) (excluding free-hauled)	56·36	44·17	41·19	48·64	40·55
Increase (+) or decrease (−)	+ 0·08	+ 0·85	− 1·55	+ 0·20	− 0·17
Freight traffic receipts	£6,929,835	£1,157,000	£2,243,500	£2,915,000	£391,890
Increase (+) or decrease (−)	− £213,529	− £28,000	− £103,500	− £45,000	− £33,111
Receipts per ton-mile	1·340d.	1·22d.	1·31d.	1·38d.	1·66d.
Increase (+) or decrease (−)	− 0·003d.	− 0·02d.	—	—	− 0·01d.
Freight train-loads—					
Average train-load (tons)	127·52	133·33	132·52	125·20	107·27
Increase (+) or decrease (−)	− 3·01	− 2·26	− 5·52	− 1·54	− 4·54
Net ton-miles—					
Per train engine-hour	1,021·09	1,099·02	1,069·08	983·72	857·59
Increase (+) or decrease (−)	+ 8·30	+ 17·48	− 2·87	+ 17·99	− 28·66
Per shunting-hour	871·85	802·27	949·84	901·93	582·31
Per total engine-hour	470·29	463·74	502·97	470·53	346·82
Net ton-miles per route mile per working day	2,719	2,678	2,874	3,213	1,192
Increase (+) or decrease (−)	− 74	− 25	− 126	− 61	− 71
Wagon-miles. Total	357,843,102	64,963,840	123,300,414	149,863,744	17,407,685
Increase (+) or decrease (−)	− 6,726,456	+ 383,777	− 1,829,580	− 4,056,843	− 1,035,125
Percentage of loaded to total	66·45	67·32	63·96	68·24	65·95
Wagons per train—					
Total	34·63	35·16	35·33	34·44	31·30
Increase (+) or decrease (−)	− 0·51	+ 0·01	− 0·40	− 0·73	− 1·29
Loaded	23·01	23·67	22·60	23·50	20·64
Empty	11·62	11·49	12·73	10·94	10·66
Train-miles. Coaching—					
Per train-hour	15·17	14·06	14·30	14·55	17·70
Per engine-hour	12·19	11·23	11·17	11·15	14·59
Train miles. Freight—					
Per train-hour	9·40	9·96	9·45	9·14	9·82
Per engine-hour	3·69	3·49	3·84	3·75	3·19
Engine-miles. Total	44,879,231	7,115,556	12,361,502	16,585,883	5,897,427
Increase (+) or decrease (−)	+ 211,690	+ 90,404	+ 28,779	+ 65,199	− 2,644
Mileage run by engines. Total train-miles—					
Coaching	21,980,996	3,005,323	5,017,375	6,994,465	4,271,498
Freight	10,332,247	1,847,909	3,495,258	4,351,475	556,082
Engine-hours in traffic. Total	4,810,019	821,510	1,430,355	1,872,602	487,235
Increase (+) or decrease (−)	− 57,498	− 4,538	− 24,003	− 24,034	− 5,161
Shunting miles per 100 train-miles—					
Coaching	7·48	6·92	6·49	8·21	8·25
Freight	73·04	83·03	68·58	68·67	96·91

* All standard-gauge railways

Passenger Traffic Statistics: Number of journeys, receipts, and receipts per journey (excluding season ticket holders)—March, 1935

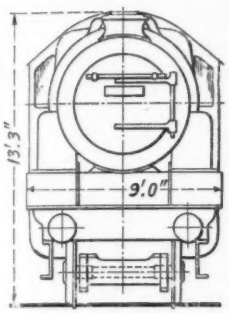
Subject	Great Britain	Great Western	London & North Eastern	London Midland & Scottish	Southern	Cheshire Lines Committee	Liverpool Overhead	London Passenger Transport Board†	Mersey
Full fares—									
Passenger journeys	30,400,674	636,155	1,077,040	1,445,520	2,468,294	17,716	145,939	23,785,204	80,626
Gross receipts	£760,423	£63,791	£98,143	£106,550	£154,774	£2,367	£1,508	£318,267	£1,430
Receipts per passenger journey	6·00d.	24·07d.	21·87d.	17·69d.	15·05d.	32·07d.	2·48d.	3·21d.	4·26d.
Reduced fares—									
Excursion and week-end—									
Passenger journeys	35,446,137	3,792,141	8,028,187	12,637,459	7,742,084	365,590	73,444	1,224,683	594,762
Gross receipts	£1,770,978	£265,037	£398,557	£644,972	£380,850	£18,710	£642	£26,734	£8,804
Receipts per passenger journey	11·99d.	16·77d.	11·91d.	12·25d.	11·81d.	12·28d.	2·10d.	5·24d.	3·55d.
Workmen—									
Passenger journeys	25,891,490	1,845,075	3,437,195	6,874,672	5,476,858	228,344	202,782	6,740,092	198,946
Gross receipts	£374,829	£27,079	£55,403	£110,030	£89,994	£3,923	£1,658	£74,367	£1,816
Receipts per passenger journey	3·47d.	3·52d.	3·87d.	3·84d.	3·94d.	4·12d.	1·96d.	2·65d.	2·19d.
Other descriptions—									
Passenger journeys	3,615,125	417,392	912,175	1,068,392	674,216	50,871	43,973	374,120	10,433
Gross receipts	£277,014	£42,839	£65,296	£101,992	£57,414	£3,580	£275	£3,287	£187
Receipts per passenger journey	18·39d.	24·63d.	17·18d.	22·91d.	20·44d.	16·89d.	1·50d.	2·11d.	4·30d.
Total—									
Passenger journeys	95,356,650	6,690,763	13,455,649	22,027,693	16,361,948	662,541	466,198	32,124,099	884,767
Gross receipts	£3,187,835	£398,746	£618,811	£966,203	£683,525	£28,599	£4,083	£422,655	£12,237
Receipts per passenger journey	8·02d.	14·30d.	11·04d.	10·53d.	10·03d.	10·36d.	2·10d.	3·16d.	3·32d.

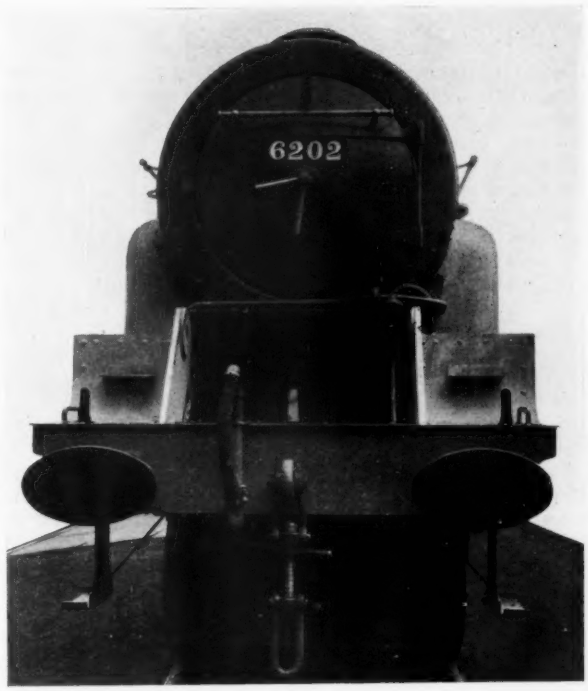
† Includes passengers originating on the railway undertakings, and on the Whitechapel and Bow Joint Railway

NEW TURBINE-DRIVEN 4-6-2 EXPRESS LOCOMOTIVE, L.M.S.R.

This design incorporates a 2,000-h.p. non-condensing, multi-stage forward turbine and a reverse turbine of the impulse type. Gear transmission is employed between the turbines and the leading coupled axle

AN interesting development in locomotive design is marked by the completion at the Crewe works of the London Midland & Scottish Railway Company of a new 4-6-2 type express passenger locomotive which, in place of the usual 4-cylinder reciprocating type of steam engine, is provided with steam turbines and gear transmission to the coupled wheels. It is anticipated that this arrangement will realise a saving of 15 per cent. in coal. In this locomotive, which has been built to designs prepared by Mr. W. A. Stanier, the Chief Mechanical Engineer, the turbine is of the Metropolitan-Vickers, Lysholm-turbomotive type, manufactured by the Metropolitan-Vickers Electrical Co. Ltd. at Trafford Park, Manchester. The turbine is mounted on the locomotive frames which were sent specially to the Trafford Park works for that purpose. The locomotive is numbered 6202, and, except for the provision of the turbines and transmission gear, the wheelbase and general appearance are similar to the existing *Princess Royal* and *Princess Elizabeth* engines, built at Crewe works and put into traffic in 1933. The photographs and drawings reproduced, together with the accompanying particulars, enable the general features of the design to be appreciated.





The provision of a turbine as the prime mover was carefully investigated. Taking into account the fact that the locomotive will be required to work through trains of 500 tons or more between Euston and Glasgow, it was decided that the turbine should be 2,000 h.p. non-condensing, using steam at 250 lb. per sq. in. with a steam temperature of approximately 750° F. The main motive power unit comprises a multi-stage turbine and treble reduction gear, while for reverse running a separate turbine is provided, having an additional single reduction gear, making in all inclusive of reversing, a quadruple reduction gear between the turbine spindle and the driving axle. The turbines, which as intimated above are of the non-condensing type, are bolted to the outside of the side frame plates of the engine with their spindles transverse to the track, the main turbine on the left-hand side and the reverse turbine on the right-hand side. The gear casing is carried between the side frame plates immediately below the boiler.

Main Turbine and Reduction Gear

In the main turbine the number and type of the stages have been chosen so that a high turbine efficiency is maintained over a wide range of engine speed. Steam from the boiler is led to a steamchest formed as a steel casting containing six control valves which are hand operated from the cab. From the steamchest, the steam passes through flexible pipes to groups of nozzles in the high pressure end of the turbine cylinder, each nozzle group being controlled by one of the six valves. The speed of the turbine, which governs that of the locomotive and train, is controlled by hand from the cab, by opening these control valves progressively, the steam from the turbine exhausting to the atmosphere through the smokebox and chimney in the ordinary manner.

The turbine spindle is directly coupled to the high speed gear pinion, a thoroughly flexible drive being ensured by an intermediate hollow quill shaft fitted with a pair of flexible diaphragm couplings. The treble reduction gear is of the double helical type completely enclosed in a fabricated gear case, suspended from three supports on the engine frame, and restrained from moving sideways relatively to the turbine. The first and second reduction pinions have been made slightly flexible to equalise the pressure along the teeth.

To take up any relative movement between the engine frame and the driving axle, the final drive from the slow speed gear wheel to the crank arms formed on the main driving axle is a very flexible one. The slow gear wheel encircles this driving axle and is coupled to it by a series of floating links. Leaf springs between the rim and the boss of this slow speed gear wheel prevent transmission of shocks to the high speed gearing.

Reverse Turbine and Control Mechanism

The reverse turbine is of the impulse type, with, as stated, an additional single reduction gear, the wheel shaft of which is in line with the high speed pinion of the main gear. For reverse running this wheel shaft of the reverse element is coupled to the main gear by a mechanical clutch operated from the cab. The steamchest for the reverse turbine contains three control valves

but in other respects the arrangement is similar to that of the main turbine.

The method of operation of the locomotive differs considerably from the orthodox type, since provision has to be made for reversing by means of a dog clutch situated between the reverse turbine and the final drive. The forward turbine is permanently connected to the locomotive drive, and, when it becomes necessary to reverse, the steam supply to this unit is shut off, and the drive from the reverse turbine engaged by means of a steam operated arrangement. This can be achieved only when the engine is stationary, a safety device being incorporated in the transmission, to prevent the change being made whilst the engine is in motion. When the drive from the reverse turbine has been engaged, the steam supply to this unit can be opened and in view of the fact that, as already mentioned, the forward turbine is permanently in connection with the locomotive drive, this unit must also revolve in the reverse direction when the engine is travelling tender first. Provision is therefore made for a steam feed to the forward turbine during this period to provide the necessary cooling, this being automatically controlled from the reverse gear.

The steam supply to the two turbines is taken first through the main regulator on the boiler (which is kept fully open while the engine is in motion), and then to the regulators on the nozzles of the two turbines, six of which are provided for the forward turbine and half that number for the reverse. These are operated from the control box in the cab, and, by means of suitable interlocking devices between the reversing clutch mechanism and the turbine regulators, it is impossible to admit steam to the forward turbine when the reverse turbine is in gear, or *vice versa*. The fact of the reverse turbine being provided with only three steam nozzles as compared with the six of the main turbine is explained by the fact that the use of this turbine will be necessary only when the engine is running from shed to terminus, shunting for attachment to the train, and such like duties not requiring high power development.

Lubrication of the Turbines and Transmission

All the bearings for the turbines and transmission gears, &c., are lubricated by mechanical means from an oil well at the rear end of the gear casing, in which is housed a submerged gear pump. This pump delivers oil at 25 lb. per sq. in. through internal channels to gearcase sprays and the bearings of the turbines and gears. A second pump is carried on the main frames under the footplate and is steam driven, its function being to augment the supply from the gear pump, and also to provide the necessary means for passing the oil through an oil cooler situated between the frames at the front of the locomotive. This pump can be maintained in motion when the engine is standing, the steam supply being controlled from the footplate, and the oil circulation maintained until the engine is again set in motion, when the gear pump automatically comes into operation.

Boiler and Firebox Details

The design of the boiler and firebox respectively is shown in the accompanying drawings. The boiler barrel tapers from 6 ft. 3 in. diameter at the throat plate to 5 ft. $8\frac{5}{8}$ in. diameter at the smokebox tubeplate. A combustion chamber is provided, and this, of course, increases the firebox heating surface. An improvement in combustion is as a consequence anticipated, although the distance between the tubeplates for this boiler barrel is now 19 ft. 3 in. whereas in the *Princess Royal* class the figure is 20 ft. 9 in.

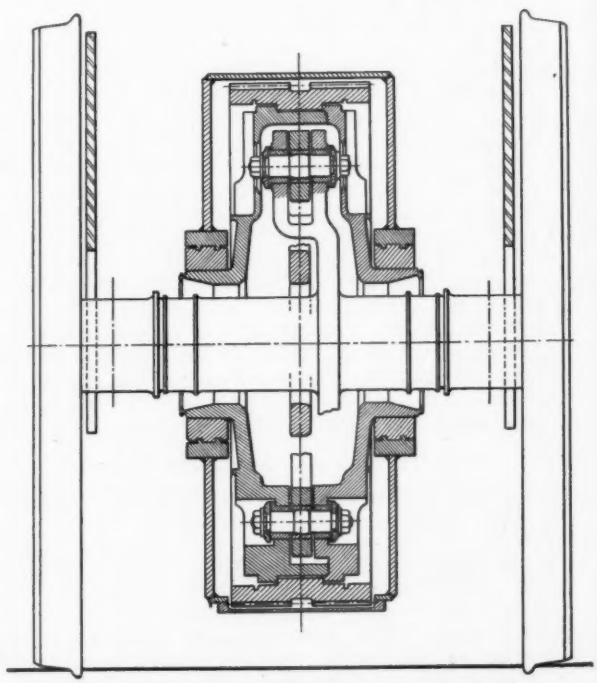
It was very necessary to keep the weight down as far as possible on this locomotive, and with this end in view the boiler barrel plates and firebox wrapper plates are made of 2 per cent. nickel steel. The smokebox tubeplate is of the drumhead type. The tubing arrangement consists of:—

32 steel superheater tubes ..	$5\frac{1}{2}$ in. outside diameter.	7 S.W.G.
112 steel boiler tubes ..	$2\frac{1}{4}$ in. outside diameter.	11 S.W.G.

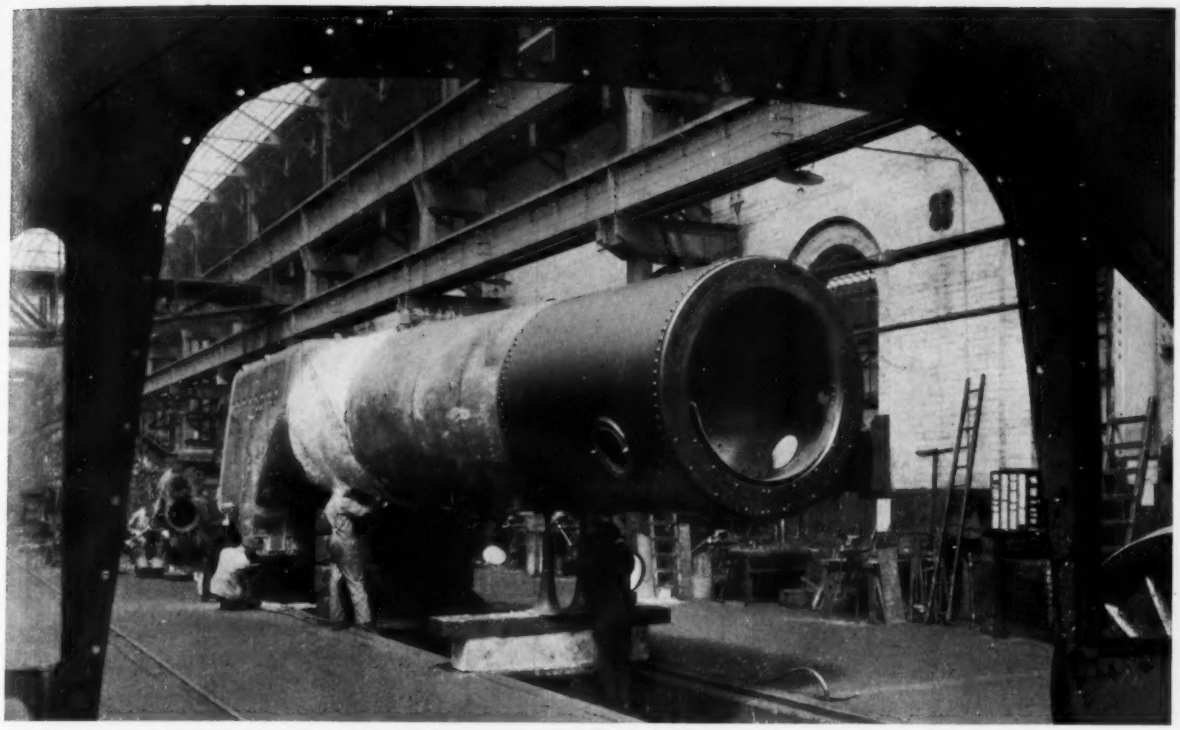
It will be noted that the flue tubes are of steel, the ends at the firebox tubeplate being specially thickened up and screwed 11 threads per in. The flue tubes and the small boiler tubes are expanded in position and beaded over in the firebox tubeplate. For both superheater and boiler tubes six-roller expanders were used which provide a slight taper in the tube end, the larger diameter being on the water side of the tubeplate. The pitching of the boiler tubes allows for diagonal and vertical bridges of $\frac{7}{8}$ in. Between the tubes and the boiler barrel ample water space has been allowed, providing efficient water circulation.

In addition to the riveted boiler joints welding has been introduced round the seams of the steel wrapper plate and along the longitudinal barrel joints for a distance of 1 ft. from each end. The circumferential barrel joints are also welded along the bottom for a distance of 2 ft. Further, the bottom corners at the foundation ring joints, and all pads on the doorplate and boiler barrel for mountings, are welded after riveting. The smokebox tubeplate and firebox doorplate are stayed with the usual type of longitudinal stays.

At the foundation ring the firebox tapers from 6 ft. $10\frac{3}{4}$ in. outside at the front end to 6 ft. $2\frac{7}{8}$ in. outside at the doorplate. This has been specially arranged to facilitate satisfactory hand firing in the back corners. The provision of a large oval fire hole, which is 1 ft. 7 in. wide by 1 ft. 2 in. deep, also helps in this direction. The width of the foundation ring is $3\frac{3}{4}$ in., and the waterlegs gradually widen to $5\frac{1}{2}$ in. at the top of the firebox to facilitate water circulation. The

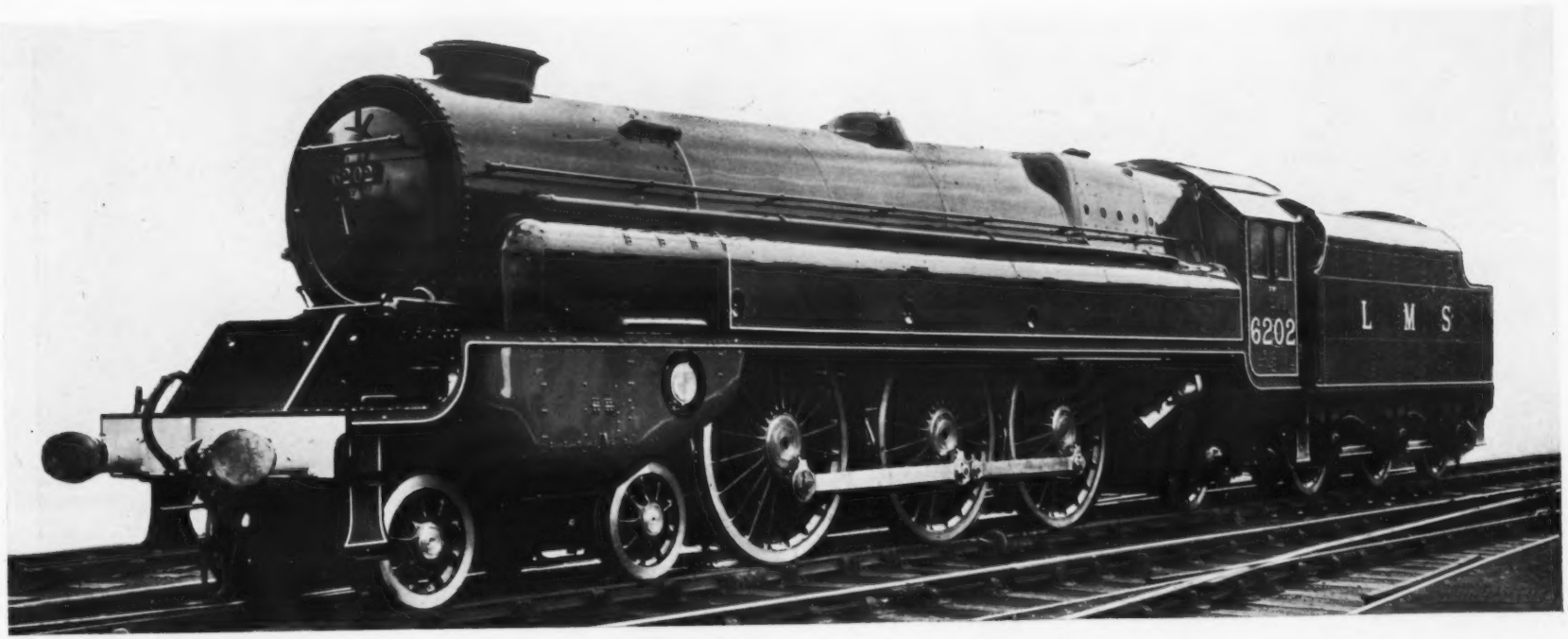


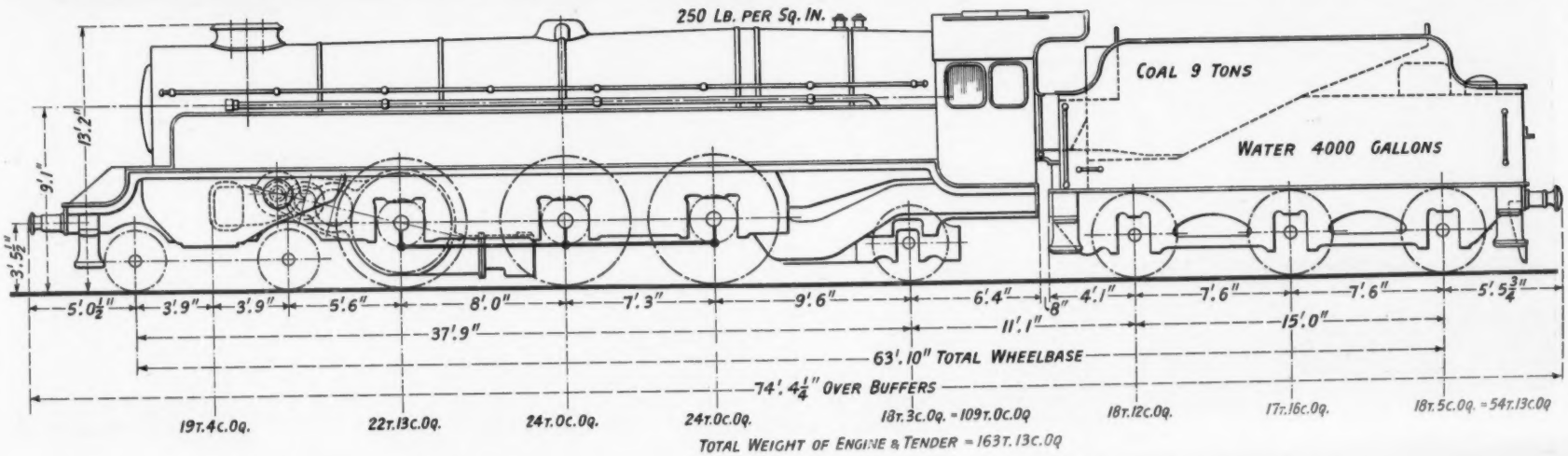
Cross section through quill drive on main driving axle



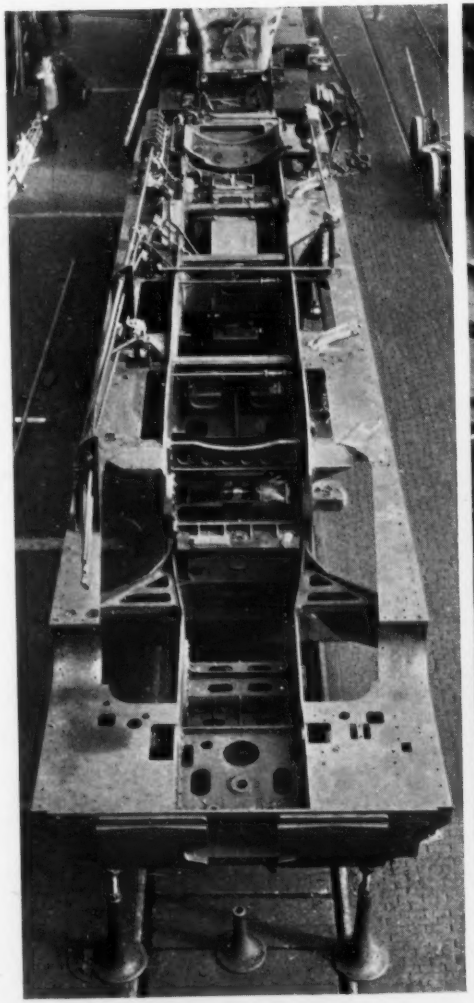
Boiler as seen through cab of locomotive before mounting

View of erecting shop bay through opening in cab



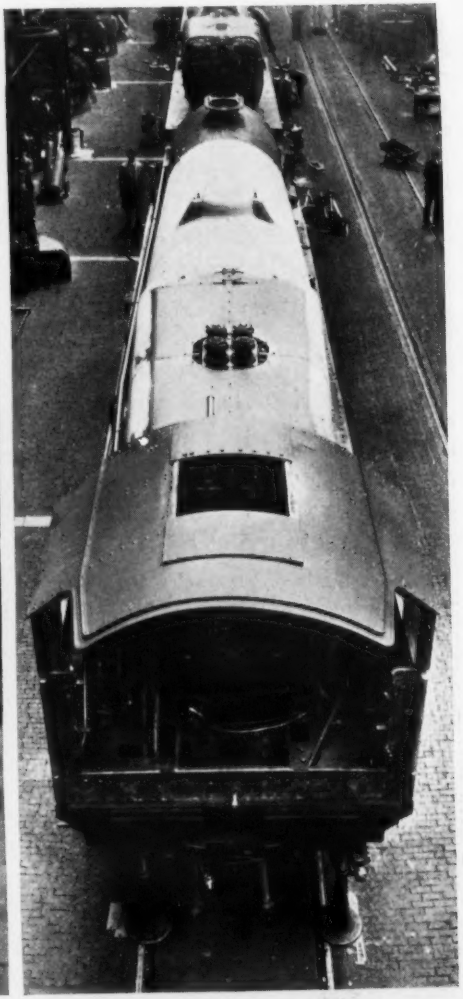


New 4-6-2 type geared turbine express locomotive L.M.S.R. main turbine side. Note weight distribution on coupled wheels



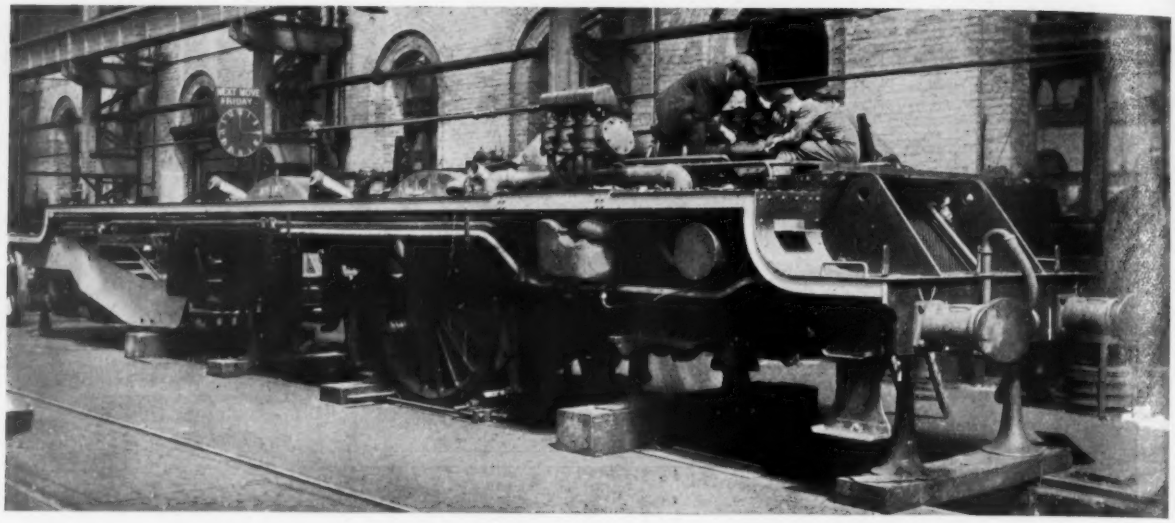
The chassis nearing completion

Lowering the boiler on to the frames

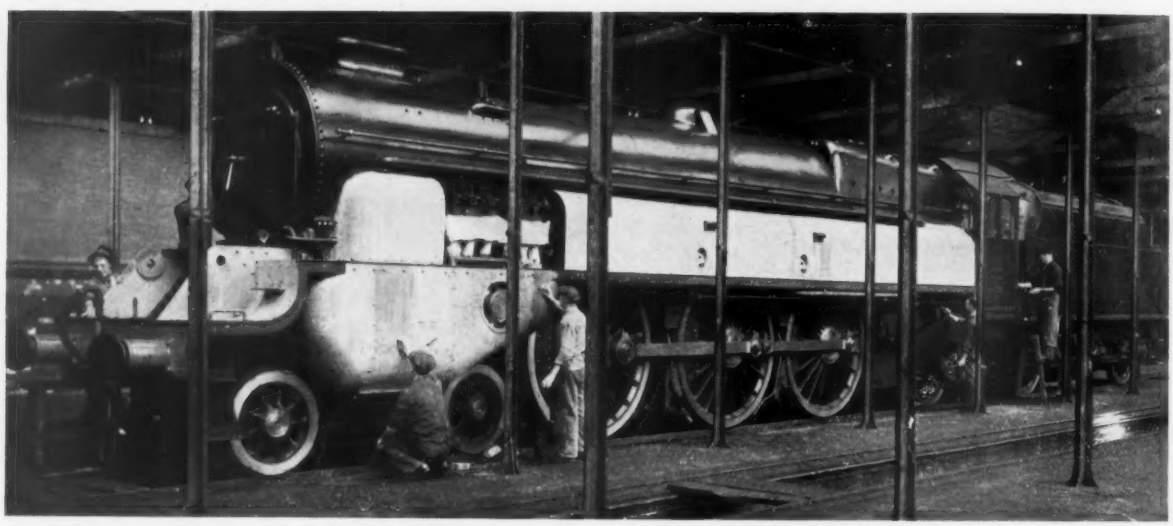


Overhead view of locomotive

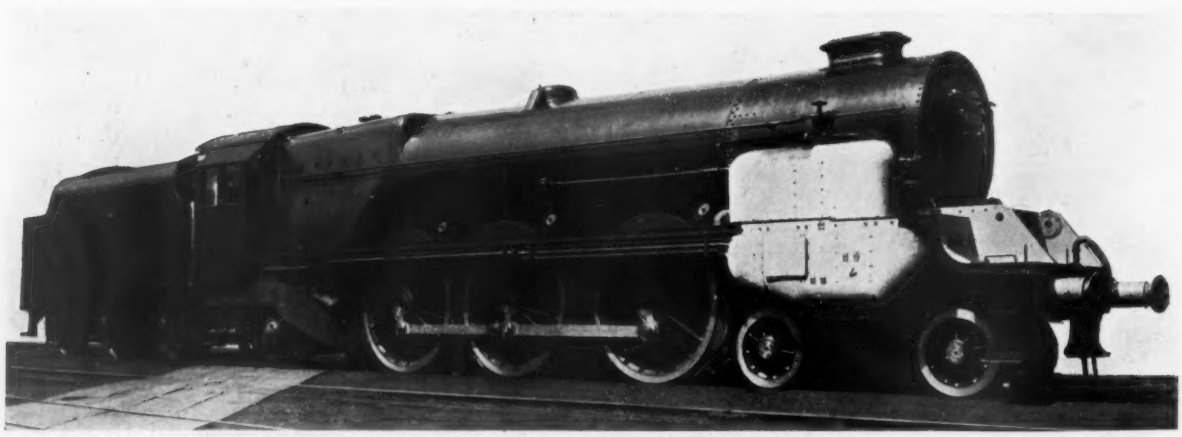
STAGES IN THE CONSTRUCTION OF THE NEW TURBINE LOCOMOTIVE AT CREWE WORKS, L.M.S. RAILWAY



A stage during erection in the Crewe works. Fitting forward turbine steam nozzles and piping



Engine in the paint shop (main turbine side; part of casing removed)



General view of locomotive before finished painting (reverse turbine side)

dimension between the copper crown plate and the steel wrapper plate is 2 ft., to provide ample steam space above the water level. The provision and position of mud plugs and mud doors has received careful attention from the point of view of thoroughly washing out the boiler and firebox.

Boiler Staying and Mounting

Monel metal stays $\frac{7}{8}$ in. diameter, 11 threads per in., are provided on the two outer side rows and on the top six rows. On the doorplate the top three rows of stays are copper, $\frac{7}{8}$ in. diameter, 11 threads per in. The other stays are of mild steel $\frac{5}{8}$ in. diameter, 11 threads per in. to the following particulars:—

Tensile strength:—32 to 37 tons per sq. in. with an elongation of 28 per cent. to 23 per cent. over a parallel length of 3 in.

The copper stays are riveted over, both on the outside of the steel plate and on the inside of the copper plate, but for the steel and Monel metal stays a nut is provided on the inside of the copper plate. The stays are caulked both on the steel and copper plates. Monel metal stays are also used in the curved portions of the throat plate, the remaining stays on the flat portion of the throat plate being of mild steel.

The safety valves, water gauge frames and protectors and other fittings are of the railway company's standard types. There are four pop type safety valves $2\frac{1}{2}$ in. diameter, set at 250 lb. per square in. pressure. As previously stated, 32 flue tubes have been provided in the superheater, the elements ($1\frac{1}{4}$ in. o.d. × 13 s.w.g.) of which are of the bifurcated type from single downcomers ($1\frac{5}{8}$ in. o.d. × 10 s.w.g.) carrying spherical ball joints to the superheater header. The main steam pipe is of the steam collector and drier type, the inlet being at the highest point of the firebox above the tube plate; the steam being then conveyed along the top of the boiler to the combination regulator and superheater header.

The regulator is incorporated with the superheater header casting inside the smokebox. The control for the main regulator is of the usual type at the firebox doorplate, and to ensure easy manipulation the regulator handle is balanced. A small sight-feed lubricator in the cab, under the control of the driver, supplies lubricant to the regulator valve.

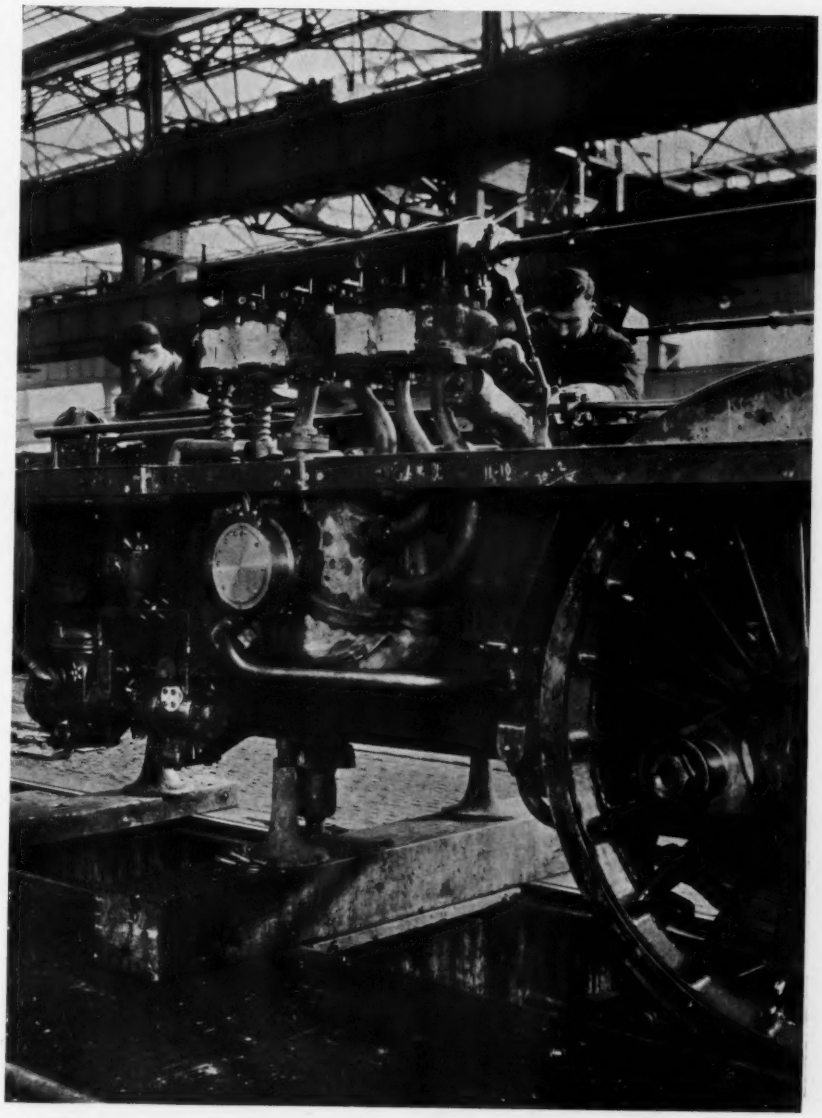
Controls for Steam Supply

A steam manifold is provided on the top of the firebox doorplate in the cab, and carries valves for the injectors, ejector, steam brake for the engine and tender, carriage warming, pressure gauge, gear case oil circulating pump, sight feed lubricator to regulator, and whistle.

The steam supply can be shut off by means of a single valve, through which steam is supplied to the manifold. The whistle is placed in a horizontal position to be within the overall height above the rail. The blower valve is fitted on the firebox doorplate on a separate pad below the main regulator, in a convenient position for the enginemen.

Injectors

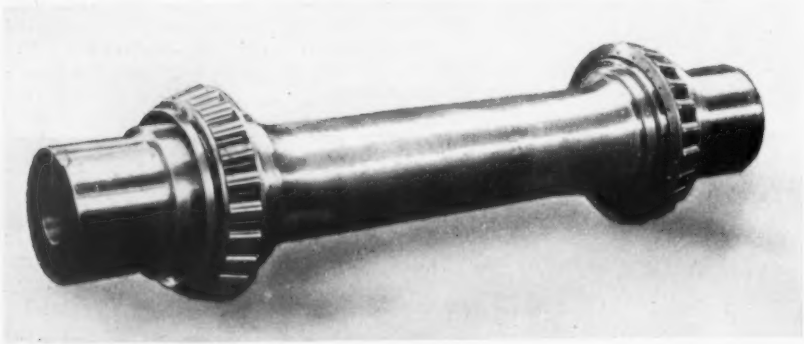
The injector on the fireman's side is an exhaust steam injector with 12 mm. cones, and on the driver's side a live steam injector with 13 mm. cones is fitted. The exhaust steam injector feeds through a feed-water heater supplied by steam taken from the forward turbine. Both injectors deliver the feed water to the boiler through top feed clack valves. Sliding trays are fitted underneath the water delivery nozzles inside the boiler to permit periodic cleaning. The driver's brake valve controls simultaneously the application of the steam brake on the engine and the vacuum brake on the train. The valves controlling the supply of steam to the large and small ejectors are incorporated in the same fitting.

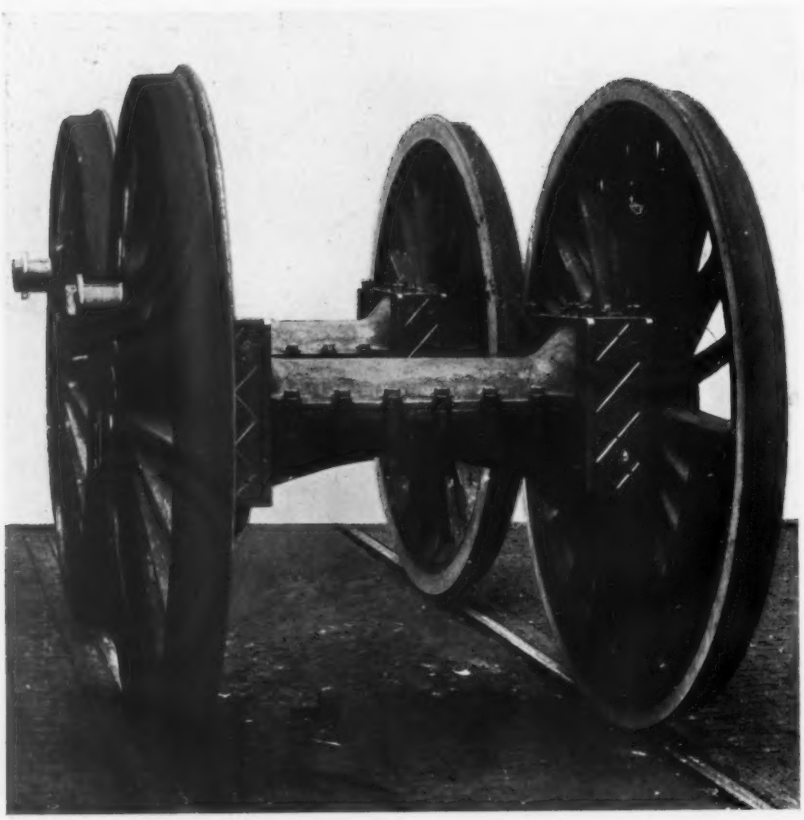


Forward turbine with steam nozzles and piping; left-hand side of engine

The firegrate is built up of three rows of cast-iron firebars, the front two rows being sloped and the hind ones level. The ashpan is provided with front, middle and hind damper doors. In addition, side damper doors are fitted between the bottom of the foundation ring and top of the ashpan side, so that sufficient primary air will be available at the sides of the wide firebox. The three main ashpan dampers, front, middle and hind, have separate control handles provided in the cab, and an additional handle is provided to control the side ashpan dampers.

Below: Coupled wheel axle with Timken roller bearings





Intermediate and trailing coupled wheels complete

Special Smokebox Arrangement

The provision of a turbine in place of the reciprocating power unit has necessitated a considerable modification in the smokebox arrangement, and in view of the low pressure exhaust of the turbine, it was necessary to provide a double exhaust type of blast pipe which, in turn, calls for a double chimney. The blast arrangement is of a variable pattern consisting of a central cone dart which is raised and lowered automatically above the blast pipe cap orifice as the number of steam nozzles for the turbine is increased or decreased. A special type of intermediate petticoat to the blast pipe cap is also used. Special joints at the smokebox side are provided between the steam pipes and the turbine steamchest, to ensure the necessary flexibility for expansion, &c.

The Locomotive Frames

The main frames of the engine are of high tensile (35-43 ton) steel, the distance between them is 4 ft. 1½ in., and their thickness 1¼ in. Advantage has been taken of this extra thickness to omit the usual type of horizontal frame cross stretchers, as it is considered that over-staying of the frames laterally is likely to interfere with their flexibility.

In addition to the vertical stretchers provided on the intermediate and trailing coupled wheel axlebox guides, cross stays have been provided to prevent the frames coming in at the bottom which is a common trouble when such large boilers are placed in position. Two separate hind frame plates are provided at each side, and spliced to the main frame, the outer hind frames being splayed outwards and carried through to the hind buffer beam. These frames are 1 in. thick. The inner frames, 1 in. thick, are set slightly inwards to take the centre casting for the trailing two-wheeled truck, and these are also carried through to the hind buffer beam and the main centre drag box casting. Due to the limitations to the depth of frames just below the throat plate of the firebox, careful scheming was necessary to provide the strength required to resist the heavy stresses imposed when lifting the completed engine. All the rivets at the main frame joint are a turned driving fit and riveted cold, and, in addition, the joint is welded at all the outside edges.

The carrying of the boiler at the front end of the frames is just behind the smokebox tubeplate, and the second support is between the intermediate and trailing coupled wheels. A gunmetal bearing strip is provided between the bearer and the frame support for the necessary movement due to expansion, and, in addition, clips are fitted at the side.

At the front end of the firebox, the foundation ring is utilised as an-

other sliding support, and on the bottom face of the foundation ring a gunmetal bearing strip is fixed. At the hind end of the firebox, the foundation ring is carried below the plate joints, and a diaphragm consisting of two plates $\frac{3}{8}$ in. thick is rigidly attached approximately in a vertical plane to this projection, and the bottom edge of the diaphragm is fixed to the steel casting which forms the dragbox.

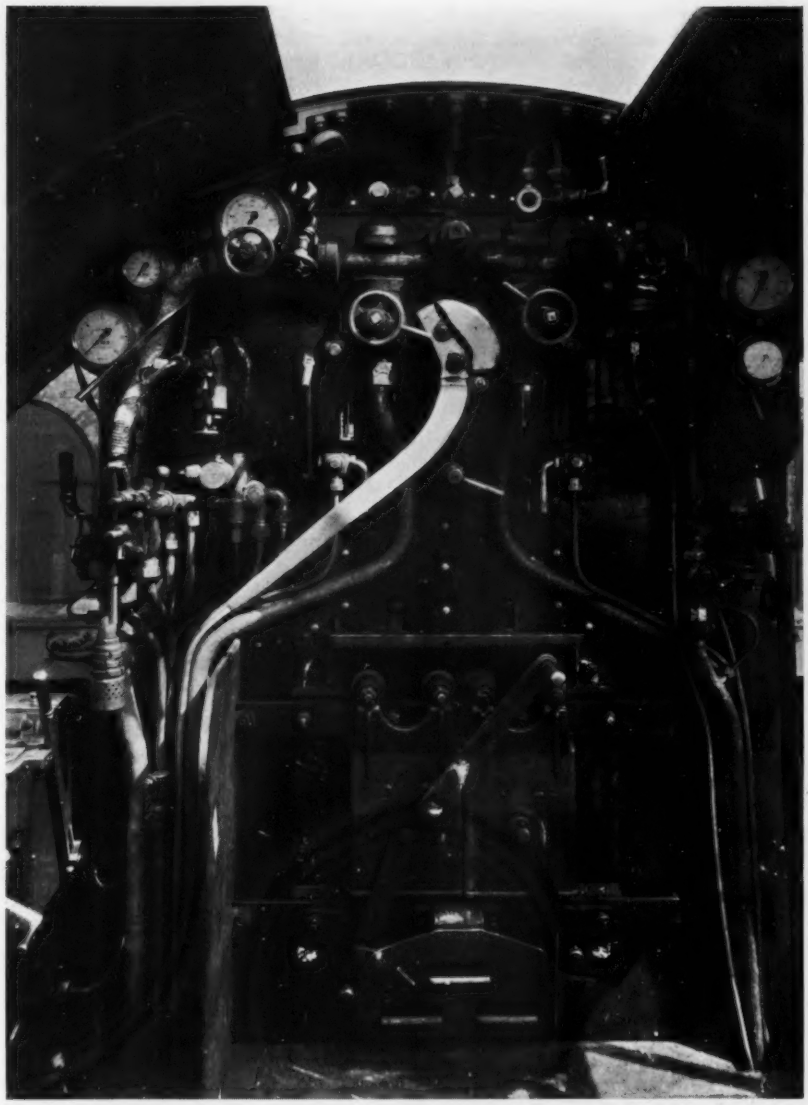
Springing and Brake Gear

All the laminated bearing springs for the engine and tender are made of silico manganese steel, the plates being of a ribbed section with cotter type fixing in the buckle. The spring links are screwed to permit of adjustment.

The screwed ends of the spring links have a Whitworth thread, and, to provide for the necessary movement at the ends of the springs, the links pass through a shoe which is provided with a gunmetal seating and a spherical washer of steel the surfaces of which are ground. Damper springs consisting of alternate layers of thin steel plate and rubber are also provided between the spring link heads and the frame brackets. The engine is provided with a steam brake which operates at the front of each of the coupled wheels.

Coupled Wheels and Intermediate Drawgear

All the journals of the coupled wheels are provided with roller bearings supplied by British Timken Limited. Wells are arranged in the underside of the boxes, to supply the necessary lubrication. The intermediate drawgear between the engine and tender is controlled by a laminated spring housed in the tender dragbox. The main drawbar is directly connected to the spring buckle. The side buffing spindles have specially designed heads which ride on case-hardened inclined planes riveted to the hind engine buffer beam. The object of this is to obtain smooth riding between the engine and tender.



Interior of cab showing control, &c., fittings and special fire door

Leading and Trailing Trucks

The wheelbase of the leading bogie is 7 ft. 6 in. and the diameter of the wheels 3 ft. Bar frames are used, and a centre cross casting in which engages the engine bogie pin, also provides the slides. The springs for the bogie bearings are of the inverted laminated type with screw adjustments, the material being similar to the springs for the coupled wheels. Timken roller bearings are fitted to the axlebox journals. Side bolsters transmit the load from the main frames to the bogie. Suitable lubrication is provided for both the bolster and cup and sliding face.

The trailing two-wheeled truck is of the bissel type, and the bogie arm is anchored at a point 6 ft. 10 in. in front of the axle centre to the engine cross stretcher casting immediately in front of the firebox throat plate. The diameter of the wheels is 3 ft. 9 in. on the tread. Timken roller bearings are fitted to the axlebox journals. The transmission of the weight from the main frames to the bogie is, in this case also, by means of side bolsters, but due to the limitation of the design, these are placed inside the bogie wheels.

A higher axle load on this locomotive has been permissible by reason of there being no hammer-blow, the only parts requiring balancing being the coupling rods and crank pins, which being revolving parts are perfectly balanced. The wheel centres are steel castings, and the wheel rim is of a triangular section. The tyres are secured by the Gibson type retaining ring. The balance weights for the coupled wheels are built up by steel plates on both sides of the spokes, and riveted, the requisite weight being provided by filling in between the plates with lead.

Locomotive Cab

Double sliding windows are fitted on both sides of the cab, and on both sides on the outside of the cab and

between the sliding windows a small glass screen can be turned into position so that when the enginemen are looking outside the cab it acts as a draught preventer. A hinged window giving ample area for lookout is fitted on each side in the front cab plate. In this plate also a number of ½ in. holes are provided at the top so that a current of air will pass along the inside of the roof and a sliding ventilator in the cab roof itself should ensure further comfort in this direction. Tip-up seats are fixed on both sides of the cab, and, to prevent exposure to cold cross winds, gangway doors, spring controlled, are fitted between the engine cab and tender panel plate, rubber extensions being attached at the bottom of the gangway doors.

The sanding is of the mechanical trickle type, the sand being delivered in front of the leading and in front and behind the intermediate coupled wheels. In addition, a water de-sanding apparatus is provided which comes into action simultaneously with the application of sand to the rails, so that after the engine has used the sand the rails are automatically cleaned with hot water to prevent interference with the track circuits.

The standard type of carriage warming apparatus is fitted through from the locomotive to the hind end of the tender, the working pressure being set at 50 lb. per sq. in. The steam supply is led from a suitable position at the turbine exhaust, but in the event of the exhaust not being in operation, an auxiliary supply of steam is arranged direct from the boiler.

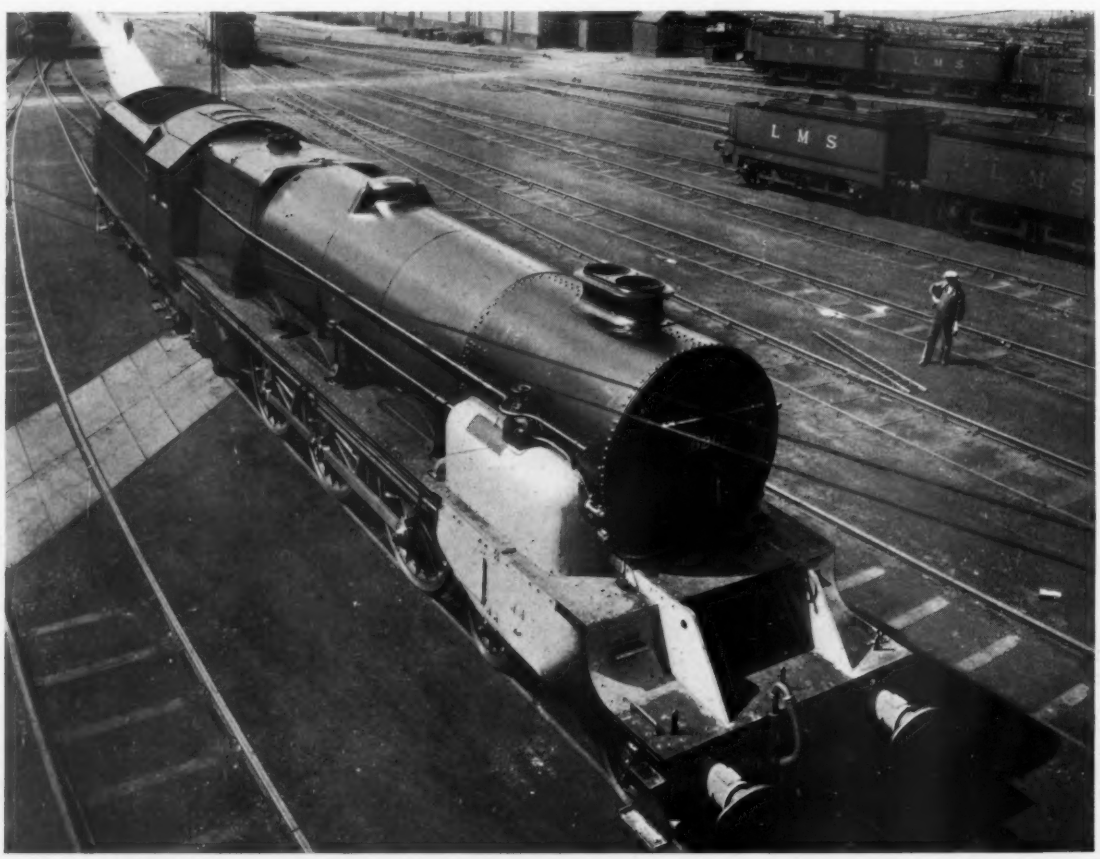
Grease gun lubrication is utilised wherever possible, as, for instance, on the brake gear and intermediate buffing gear.

The tender is carried on six wheels, with a wheelbase of 15 ft., and has a capacity for 4,000 gallons of water and 9 tons of coal. The coal bunker has been designed so that the coal will be self trimming, as far as possible. A door is arranged to give access to the coal space from the engine footplate and there are commodious toolboxes on the tender front. On the left-hand side a cavity is arranged for the accommodation of the firing irons. Hand brake apparatus is fitted to the tender wheels, in addition to the steam brake. Both the water pick-up and tender hand brake handles are arranged vertically, with bevel wheels to transmit the motion to its particular mechanism.

The following firms have supplied material and component parts for use in the new turbine locomotive:—

Component (or Material)	Manufacturer
Turbines, transmission gear, control valves, &c.	Metropolitan-Vickers Electrical Co. Ltd.
Feed water heater	Metropolitan-Vickers Electrical Co. Ltd.
Exhaust steam injector (right-hand side)	Davies & Metcalfe Limited.
Live steam injector (left-hand side)	Gresham & Craven Limited.
Axlebox roller bearings (engine and tender)	British Timken Limited.
Steam pump for oil-cooling circulation	Worthington-Simpson Limited.
Steel boiler plates for barrel and firebox wrapper 2 per cent. nickel steel	Colvilles Limited.
Superheater apparatus	The Superheater Co. Ltd.
Monel metal firebox stays	Henry Wiggin Limited.
Buffers	Geo. Turton, Platts & Co. Ltd.
Insulating material for boiler, firebox, turbines, control valves, and piping	Alfol Insulation Co. Ltd.

See editorial comment on page 1240



AN UNUSUAL RAILWAY SAFETY DEVICE

AN interesting and somewhat unusual piece of mechanism is to be found attached to a girder of the viaduct which spans the Staithes Beck, at Staithes, on the Yorkshire coast near Whitby, and carries the L.N.E.R. Loftus-Whitby branch line. The mechanism in question is technically called an anemometer but is better known by its simple description—a wind pressure gauge. The function of the anemometer is to warn the signalman in the Staithes signal box when the pressure of wind against the structure of the viaduct is too great to permit of the safe passage of trains over the viaduct.

The viaduct is situated in a very exposed position directly facing the North Sea and receives the full force of gales of wind blowing from land and sea. When the pressure of wind reaches 28 lb. per sq. ft., the anemometer, which consists of a circular shield fitted with vanes, actuates an electric trembling bell in the Staithes signal box, and the bell rings continuously so long as that or any higher pressure exists. Before rail traffic is again allowed to cross the viaduct, it is inspected by the engineering staff.

The anemometer was first installed in 1884 and since that date the warning bell has been rung on only three occasions, the last being on January 26, 1935. It was supplied and fixed by Henry J. Coles, hydraulic and general engineer, Sumner Street, Southwark, London, S.E.

Adjusting the wind pressure gauge on the L.N.E.R. viaduct which spans Staithes Beck on the Yorkshire coast near Whitby

Staithes Viaduct which carries the Loftus-Whitby branch line of the L.N.E.R.

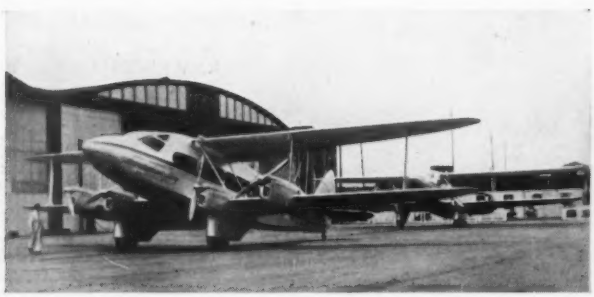
Re-fuelling the London–Isle of Wight plane on its arrival at Somerton aerodrome, Cowes. The service is operated in conjunction with Spartan Air Lines

Railway Air Services in the South of England

(*See editorial note on page* 1237.)

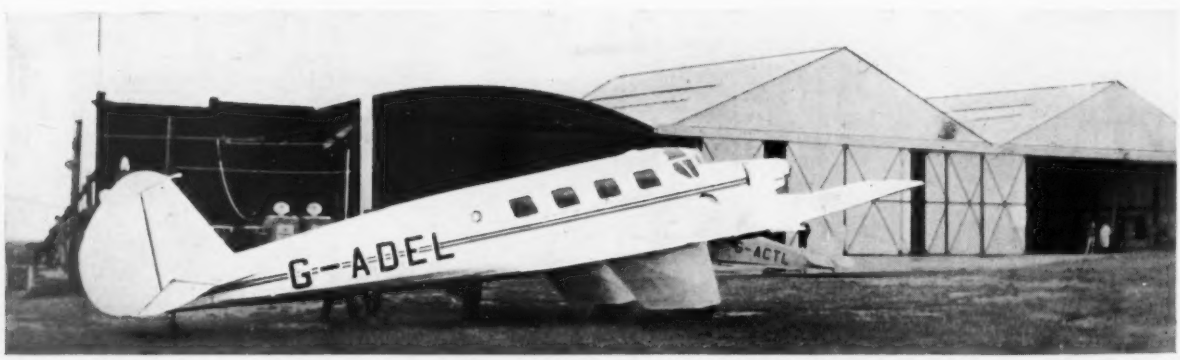
The Southampton Corporation bus which provides a connection between the West station and the municipal airport near Eastleigh

Passengers boarding a Jersey Airways plane at Southampton. Jersey Airways is controlled by Channel Island Airways Limited, a railway associate



Another view of two Jersey Airways planes at Southampton, ready to depart for Jersey, whence there is a flying-boat service to Guernsey

An R.A.S. plane at Southampton en route from Liverpool, Birmingham, and Bristol for Portsmouth and Shoreham (for Brighton)



A Spartan Air Lines plane operated for Railway Air Services on the ferry service between Southampton and the Isle of Wight at Somerton aerodrome, Cowes.

RAILWAY NEWS SECTION

PERSONAL

We regret to record the death, on June 20, of Sir Lingard Goulding, Bart., Chairman of the Great Northern Railway (Ireland), and a Director of the Metropolitan-Vickers Electrical Co. Ltd.

Mr. E. H. d'E. Darby, M.Inst.C.E., who, as announced in THE RAILWAY GAZETTE of June 7, has been appointed Assistant Engineer (Permanent Way), L.M.S.R., was educated at Cheltenham and Clare College, Cambridge University, taking the B.A. degree (Mathematical Tripos) in 1902. In October of that year he began a term of pupilage under the late Mr. E. B. Thornhill, then Chief Engineer of the London & North Western Railway. Part of this period was spent in the drawing office at Euston and part assisting on the construction of Garston New Dock, where he became Assistant to Mr. W. E. Thornhill in 1905, remaining on this work until its completion in 1910. He was then appointed Assistant to the District Engineer at Walsall, where he remained until 1917, except for a short period of railway work in France. From January, 1918, he acted as District Engineer at Crewe, which appointment was confirmed in 1919. In September, 1920, he was appointed District Engineer, Manchester, the position he held until appointed Divisional Engineer (Eastern Division), Derby, in January, 1929. In the new reorganisation of the Chief Civil Engineer's Department, the Divisional Engineers disappear and Mr. Darby has therefore been transferred to St. Pancras as Assistant Engineer, Permanent Way. Mr. Darby is a Major in the Engineer and Railway Staff Corps and a Member of the Institution of Civil Engineers.

Mr. S. O. Cotton, M.Inst.C.E., who, as recorded in THE RAILWAY GAZETTE of June 7, has been appointed Assistant Engineer (Structures), St. Pancras, L.M.S.R., was born in 1885, and educated at Wellington College, Berks. After receiving engineering training at King's College, London, he served a pupilage, from 1905 to 1908, under Mr. L. Trench, Assistant Engineer (New Works) of the late L.N.W.R., and in 1908 entered the service of that company. In 1910 he became Assistant to the Resident Engineer (Mr. J. J. Lee) for the Harrow and Bushey Widening, and in 1913 was appointed Resident Engineer for the Loudoun Road to Willesden section of the Chalk Farm and Kensal Green widening. In May, 1915, Mr. Cotton joined His Majesty's Forces as 2nd Lieutenant in the 115th Company, R.E., and eventually commanded the company for a short period before demobilisation as Major, R.E. He served in France and Belgium in 1915, and in Egypt and Palestine from 1915 to 1919, during which period he was engaged on railway construction work between Kantara (Suez Canal) and Haifa, Ludd and Jerusalem, and on a section of the Haifa and Damascus Railway. He rejoined the L.N.W.R. in August, 1919, as Assistant to the Divisional Engineer at Longsight, Manchester, retaining that position under the L.M.S.R. until 1924, when he was appointed District Engineer, Bradford, L.M.S.R. It was in September, 1931, that Mr. Cotton was appointed Divisional Engineer, Manchester, the position he now relinquishes to go to St. Pancras as Assistant Engineer (Structures).

Mr. E. H. d'E. Darby,
Appointed Assistant Engineer (Permanent Way), St. Pancras, L.M.S.R.

Mr. S. O. Cotton,
Appointed Assistant Engineer (Structures), St. Pancras, L.M.S.R.

Mr. J. W. Watkins,
Appointed Assistant Divisional Superintendent of Operation (Traffic), Derby, L.M.S.R.

Mr. J. W. Watkins, who, as announced in THE RAILWAY GAZETTE of June 7, has been appointed Assistant Divisional Superintendent of Operation (Traffic) Derby, entered the service of the former Midland Railway on April 1, 1905, as Junior Clerk at Ashchurch, and served at several stations until he joined the ranks of the Gloucestershire Regiment on August 31, 1914. He subsequently received a commission in the Field and was posted to the 2nd Battalion Lancashire Fusiliers, serving with that regiment until May, 1918, and rising to the rank of Lieutenant-Colonel in command of the battalion. He was awarded the D.S.O. and M.C. and was mentioned in despatches four times. He was wounded in May, 1918, and after recovering, served in England until leaving the Army with the rank of Lt.-Col. in July, 1919. Upon his return from Army service Mr. Watkins was posted to the headquarters staff of the former Midland Railway, dealing particularly with staff matters, and continued in the same position under the grouping. In 1926 he was appointed Assistant (Outdoor Section) Chief General Superintendent's Office, and in

January, 1932, he was appointed Assistant Divisional Superintendent of Operation, Derby, the office he now relinquishes.

Mr. D. S. Inman, who, as announced in THE RAILWAY GAZETTE of June 7, has been appointed District Goods and Passenger Manager, Leicester, L.M.S.R., joined the former L.N.W.R. in the Passenger Department at Winslow in 1911. After over a year's training, there and in the District Superintendent's office at Manchester, he was posted to various goods stations and to the District and Outdoor Goods Managers' offices in Liverpool. From August, 1914, to May, 1919, he served in the Army, after December, 1914, with the B.E.F. in France, Flanders and Italy, first with the 1st Cheshire Regiment and subsequently on the Staff of the 5th Division Headquarters. Mr. Inman returned to the Goods Department, Manchester, in 1919, and remained there until the L.N.W.R. - L. & Y. amalgamation in 1922, when he was transferred to the Outdoor Goods Manager's office at Euston. Upon the formation of the L.M.S.R. in the following year, he joined the Goods Operating Manager's office, Euston, and served in various sections of it until he was appointed Assistant District Goods Manager, Leicester, on January 1, 1928. In February, 1931, Mr. Inman was transferred to Liverpool in a similar capacity and, in November, 1933, was appointed Head of the Goods Revenue Section of the Chief Commercial Manager's Office at Euston, the position he now leaves to return to Leicester as District Goods and Passenger Manager.

Mr. James Paterson, M.C., M.Inst.T., who, as announced in our news columns last week, has consented to act as Appeal President of the General Porters' Benevolent Association, is Managing Director of Carter Paterson & Co. Ltd. and of Bean's Express Limited, as well as being Chairman of Karriers Parcels Delivery Limited and of South Coast Carriers Limited. As such he played an important part in concluding the co-ordination scheme with the main-line railways whereby in 1933 they acquired control of Carter Paterson & Co., Pickfords Limited, and their associated companies. He was born in 1884 and was educated at Shrewsbury School and Merton College, Oxford, where he took his M.A. degree. He studied for the law and was called to the Bar by the Inner Temple. During the war he served in France from September, 1914, with the London Scottish, was twice mentioned in despatches, was awarded the M.C. and was promoted to be Major. For a time during 1916 and 1917 he com-

Mr. D. S. Inman,

Appointed District Goods and Passenger Manager, Leicester, London Midland and Scottish Railway

Mr. James Paterson,

Managing Director of Carter Paterson & Co. Ltd., and Appeal President, General Porters' Benevolent Association

Mr. Cecil J. Allen,

Whose 300th "British Locomotive Practice and Performance" article appears in the July issue of *The Railway Magazine*

Railway demonstration at Hull for schoolchildren ***(See article opposite)***

On the front of the engine, reading from left to right, are Major W. H. Carver, M.P., a Director, L.N.E.R.; the Lord Mayor of Hull (Alderman A. Shepherd); the Stationmaster at Paragon station, Hull; Mr. Thomas Hornsby, Divisional General Manager, L.N.E.R., York: and the Sheriff of Hull (Councillor A. Cargill)

manded his battalion. Mr. Paterson was afterwards on the staff of the Transportation Directorate. He is a Member of the Institute of Transport, and Chairman of the City of London Maternity Hospital.

Mr. Cecil J. Allen, M.Inst.T., A.I.Loco.E., whose portrait we publish opposite, has just contributed his 300th article appearing under the title of "British Locomotive Practice and Performance" in our associated monthly contemporary *The Railway Magazine*, the July issue of which is published this week. Probably the greatest living authority on this subject, Mr. Allen does not confine his articles to British achievement only, and there are few outstanding performances by steam locomotives in any country which have not been dealt with by him in one way or another. To readers of THE RAILWAY GAZETTE and of our component *The Railway Engineer*, his name will be familiar as the author of numerous signed articles on the subject of permanent way materials, and rails in particular, on the metallurgical and production aspects of which he is also an expert. Mr. Allen is, moreover, the author of numerous books both technical and popular, the best-known in the former category being "Modern British Permanent Way," which is now out of print, and in the latter "Railways of Today: Their Evolution, Equipment, and Operation." He is also an experienced lecturer and broadcaster upon railway subjects and the considerable publicity value of his publications, lectures and broadcasts is recognised by both British and other railways, especially those of Switzerland. Mr. Allen is Technical Assistant (Materials) to the Permanent Way Engineer, Southern Area, L.N.E.R.

We regret to note the death, on June 21, of Mr. M. W. Middleton, Managing Director of the British Wagon Co. Ltd., Rotherham, and of the British Railway Traffic & Electric Co. Ltd., London. He was also a Director of the Ince Waggon & Ironworks Co. Ltd., Wigan, and of the Tondu Engineering & Wagon Co. Ltd.

We regret to record the death, on June 21, of Mr. Frank Henderson, who, until November last, was Chairman of the Central Uruguay Railway of Monte Video and Associated Lines and also of the Taltal, Buenos Ayres Midland and Chubut Central Railways.

Mr. P. H. Price, late Secretary of the Railway Clearing House, whose death we announced in our issue of April 26, left estate valued at £8,840 (£7,061 net).

Sir Alan Garrett Anderson, a Director of the London Midland & Scottish Railway, was, on June 26, returned unopposed to fill the Parliamentary vacancy in the City of London, created by the elevation of Mr. E. C. Grenfell to the peerage.

We regret to record the death, on June 15, of Mr. A. B. Crookall, J.P., M.L.C., Chairman of the Isle of Man Railway, in his 63rd year. Since June, 1930, he has also been Chairman of the Isle of Man Road Services Limited, an amalgamation of two private bus companies and the railway company's buses.

We regret to record the death, on June 18, of Mr. George Harlow, Manager of the Metropolitan-Vickers Electrical Company's Plant Sales Department, and for some years a Director of the Metropolitan-Vickers Electrical Export Co. Ltd. Educated at the Grammar School and College of Technology in Manchester, he joined the Metrovick concern in 1903 as an apprentice, and, after varied experience from 1906 onwards on the staff, represented the firm in Australia for four years and in South America for three.

INDIAN RAILWAY STAFF CHANGES

Mr. M. S. Gregory, O.B.E., M.C., V.D., Deputy Agent, N.W.R., has been permitted to retire from Government service as from May 1.

Mr. G. S. Darby, Traffic Manager, Burma Railways, has been granted six months' leave as from April 30.

Mr. R. T. Power has been appointed to officiate as Traffic Manager, and Mr. E. I. Milne as Deputy Traffic Manager, Burma Railways, as from April 30.

Mr. H. P. Burman has been appointed Deputy Chief Mechanical Engineer, Electrical, E.B.R., as from May 10.

Sardar Bahadur Ram Singh has been appointed to officiate as Deputy Chief Engineer, N.W.R., as from April 22.

Mr. C. C. T. Brereton, M.B.E. Divisional Superintendent, N.W.R., has been granted three months leave as from June 14.

Mr. E. M. Cory, Deputy Chief Engineer, Construction, G.I.P.R., has been granted nine months' leave from May 11.

Mr. E. W. Russell, Deputy Agent (Works), G.I.P.R., has been granted eight months' leave as from April 29.

Mr. E. W. Thomas, Locomotive & Carriage Superintendent, A.-B.R., has been granted leave preparatory to retirement as from April 29; Mr. W. Coltman has been appointed Locomotive & Carriage Superintendent as from the same date.

Mr. T. C. Hales, V.D., has been appointed to officiate as Chief Commercial Manager, N.W.R. as from April 1, in place of Mr. A. C. Cooper.

Railway Transport and Schoolchildren

Almost every boy at some time or other has an ambition to be an engine driver. Railways have always been a source of fascination and delight to the younger generation. In recent years the L.N.E.R. sought to turn this to good account by holding special demonstrations for schoolchildren at various centres. By doing so the company has not only been carrying out a policy of creating and fostering public interest in its multifarious activities, but it was also assisted in the extension of the policy of giving scholars opportunities of gaining knowledge of industrial undertakings at first hand as an extension of classroom teaching.

During last winter, schoolchildren's demonstrations were held at Leeds, York, Newcastle, Darlington, Hull, Durham, Scarborough, South Shields, and Harrogate and have resulted in nearly 30,000 scholars learning something of railway organisation and operation, locomotive working, permanent way and signalling equipment, and of inspecting examples of the latest types of rolling stock. The demonstrations are organised with the co-operation of the education authorities and the scholars are taken to them in organised parties in the charge of teachers. A short lecture on railway development and organisation is given to the parties before the tour of the exhibits is made. The exhibits consist of:—

A modern main line locomotive in steam.

Locomotive demonstration vans equipped with models and diagrams illustrating the mechanism of steam locomotives, heating apparatus, brake apparatus, couplings, and other rolling stock equipment.

Signalling equipment such as semaphore signals, block telegraph instruments, track circuiting, colour-light signalling, manual and power operated points.

A travelling mail van.

Rolling stock such as first and third class sleeping cars, restaurant and buffet cars, tourist train stock, and camping coaches.

All these exhibits are explained in detail to the children by competent railway staff, and the Post Office authorities have co-operated by providing lecturers to explain how the mails are dealt with in the travelling mail vans.

At all the centres at which the demonstrations have been held the Lord Mayors and Mayors have shown civic interest by performing the opening ceremonies. School principals have not hesitated to express their approval of this system of turning stations into temporary classrooms, and to pay tribute to the advantages which accrue to the scholars from this method of enabling them to learn details in a striking and interesting way of the principal transport system of the country.

In certain cases these demonstrations have resulted in special school courses on railway subjects being arranged, the scholars being provided with timetables, lists of fares, and other railway literature.

King's Cross Station, Metropolitan Line

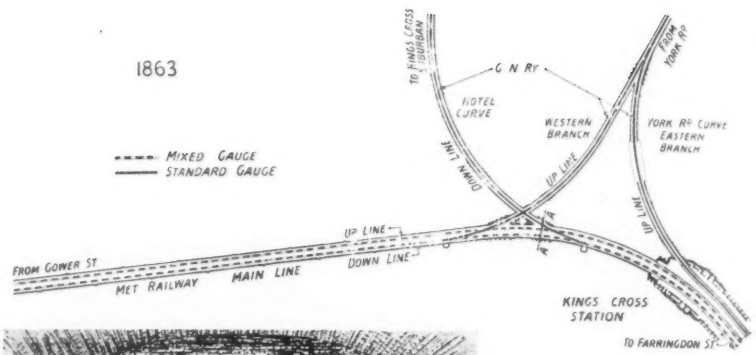
One of the important station reconstruction works contemplated by the London Passenger Transport Board, and now included in the £35,000,000 scheme for which the Government is to guarantee the loans, is that of King's Cross. So far as the Metropolitan Line station is concerned, the scheme includes moving the platform level facilities westward and constructing between the Inner Circle tracks an island platform which will extend to a point about 170 yd. westward of the present platforms. It will thus be almost directly above the tube platforms at King's Cross and more convenient intercommunication will be made possible.

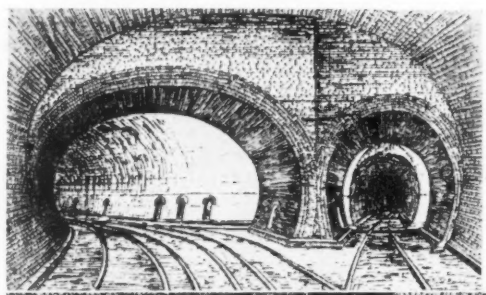
The re-arrangement however, necessitates moving the Metropolitan Up line, and to facilitate this the connecting line between the Up Circle and Up Widened lines is being abandoned. The last train ran on April 27, the rails have been removed, and the western end of the connecting tunnel is being bricked up. This tunnel was built in 1868 with the intention of making a physical connection with the L.N.W.R. at Euston, but it was never completed and remained unused until March 15, 1926, when a track laid in 1925 to connect the Circle line with the City Widened line was brought into service. The work was described in THE RAILWAY GAZETTE, of March 19, 1926. It was found that the link, being unidirectional, was not of great value and did not relieve the bottleneck between King's Cross and Baker Street, and, therefore, its traffic value does not justify rebuilding.

When the Metropolitan Railway was opened on January 10, 1863, it had only Up and Down tracks, laid to mixed gauge (4 ft. 8½ in. and 7 ft.). The Great Northern curves shown on the first of the accompanying plans were brought into service on October 1, 1863, when G.N.R. suburban trains were taken through to Farringdon Street. Apparently, the Western branch was never used for regular traffic and, when about 1865 extensive alterations to King's Cross were put in hand, it was used for dumping spoil; it has never been dismantled but remains filled up.

The alterations at this period included building a connection with the Midland Railway and also separate tracks (known as the Widened lines) from King's Cross to Moorgate for G.N.R., Midland, and L.C.D.R. traffic. The G.N.R. lines at King's Cross were slewed over to connect with the two new tracks and G.N.R. suburban trains worked over them from March 1, 1868. The Midland curve was opened for local traffic from Bedford to Moorgate on July 13, 1868, and this actually provided the first Midland terminus in London, as St. Pancras main line station was not opened for passenger traffic until October 1, 1868.

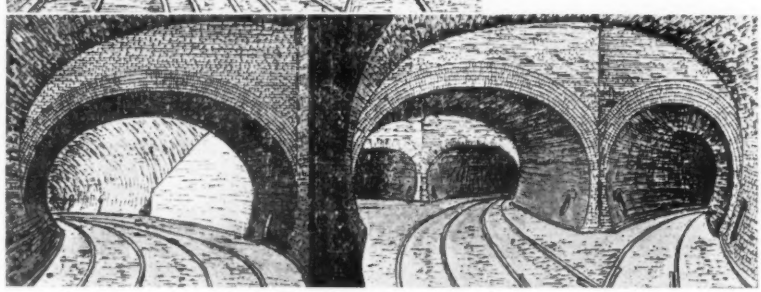
Broad gauge (G.W.R.) trains were withdrawn from the Metropolitan Railway on March 15, 1869, and King's Cross assumed substantially its present form.

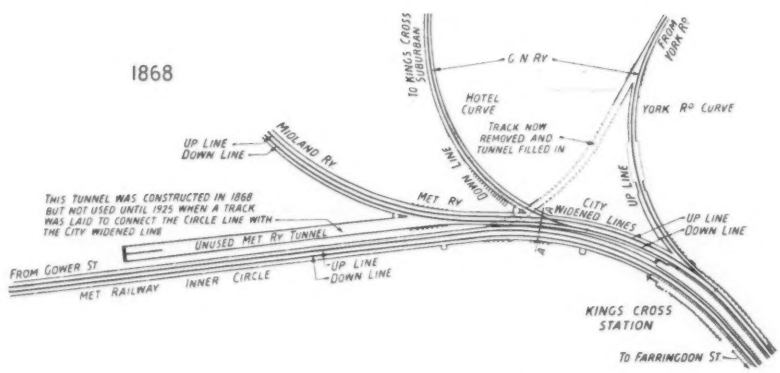


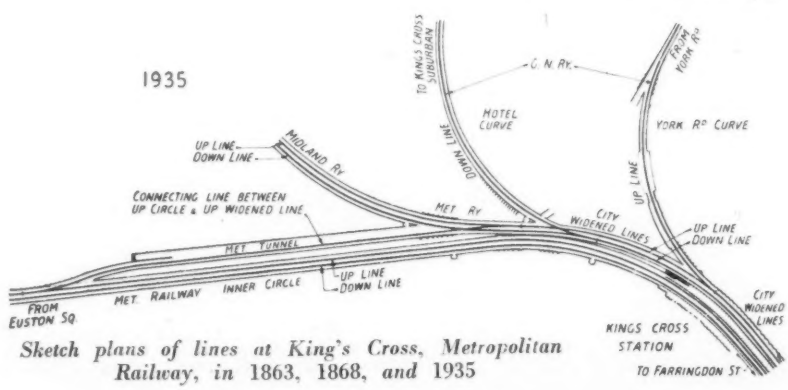


Left: View on line AA on the plan of 1863

Below: View on line AA on the plan of 1868







Sketch plans of lines at King's Cross, Metropolitan Railway, in 1863, 1868, *and* 1935

Institution of Railway Signal Engineers
Summer Meeting in Belgium

The annual summer meeting of the Institution of Railway Signal Engineers was held in Belgium from June 21 to 24; the party of 105 members and ladies travelled in two groups, via Dover-Ostend and Harwich-Antwerp, and met in Brussels on Saturday morning, June 22. The meeting was under the leadership of the President of the Institution, Mr. H. E. Morgan, Divisional Signal and Telegraph Engineer, L.M.S.R., Crewe, supported by Mr. W. S. Roberts, Vice-President; Messrs. C. H. Ellison, F. Downes, J. W. Punter, W. Challis and R. S. Griffiths, Past-Presidents; Messrs. A. Oldham, F. L. Castle, C. H. Hills, H. F. D. Page, G. H. Crook and H. M. Proud, Members of Council; Mr. M. G. Tweedie, Hon. Secretary; and Mr. T. S. Lascelles, Hon. Treasurer. The arrangements had been made by the Summer Meeting Committee, composed of the President, Hon. Secretary, and Messrs. F. L. Castle, C. H. Hills, R. S. Griffiths, and R. Falshaw Morkill.

On arriving in Brussels the party was received by M. Arnould, Assistant Signal Engineer of the Belgian National Railways, MM. Moustey and Thuysbaert, Technical Assistants, and M. Boyhaert, Stationmaster at Brussels Nord, and, while the ladies with the party made a coach tour of the city, the members were conducted by those gentlemen over the new electric power signalling installation, which is of the latest type and replaces that opened in 1905, as mentioned in the article on signalling in Belgium in our issue of June 14. Owing to the peculiar formation of the lines approaching the station, forming a bottle neck leading to 16 platform lines, the layout is rather complicated, there being a very large number of single and double slip points, with the result that some 900 routes are controlled from the frame, situated in a cabin on girders over the lines to the west of the site of the old one. The members were particularly interested in the methods adopted for obtaining sectional route locking by means of sectional route-handles, these in turn controlling the point handles in small groups and being acted on by the electric locking. The handles in the frame are arranged in two rows, signals and points in the top and route handles in the bottom. Track locking is used instead of locking bars, and all the points are trailable without damage. The condition of the track circuits in the platform lines is indicated on illuminated diagrams, and the action of the trains as they release the sectional route locking is also shown thereon by special lamps. The route handles are, it must be remembered, for locking and holding the routes only, and are not route operating handles, as in French practice.

Three-position semaphore signalling is in use, replacing the old two position signals, save on the newly electrified lines on the east side of the station, where colour-light signals are installed instead. The working of the frame, so different in several respects from that to which the visitors were accustomed, attracted great interest, and the guides were fully occupied in explaining it. An item of importance was the graphical train record of all engine and train movements, kept by the telephone operators, who are in touch with the adjacent cabins and the train despatching offices. The time available passed all too quickly and many questions remained to be asked when the party adjourned to the Palace Hotel for the official luncheon.

Mr. Morgan proposed the toast of the Belgian Royal Family—with which M. Arnould courteously begged to associate that of King George V and Queen Mary—and then that of prosperity to the Belgian Railways, which had afforded such excellent facilities to members. The President referred to the visit ten years before, under the leadership of Mr. A. F. Bound, from whom a telegram had been received that day wishing success to the meeting, and reviewed the steps taken by the Belgian railways to restore their lines after the war. The visit this year was at an opportune time, for Belgium was celebrating the centenary of her railway system, and there was the magnificent International Exhibition. Although some things had changed since 1925, the warmth of the welcome they received had not done so, and they were very grateful for the kindness extended to them. Mr. Morgan gave some statistics showing the enormous work done in restoring the railway system after the Armistice, evidence of a progressive spirit of which the splendid power cabin they had seen that day was an outstanding example. He also spoke of the work done by British engineer forces in the Army and how much of it had lasted in service for years after the war.

M. Arnould, in reply, expressed the pleasure of his management at seeing the representatives of a friendly nation among them, and their admiration for the work done by British signal engineers, work which had in no small degree contributed to the success attending the new methods adopted in Belgium in recent years. He thanked Mr. Morgan for his remarks and especially for his kind offer to extend a welcome to visitors in England. M. Arnould touched on the problems facing them after the war and the way in which they had been met in Belgium, and concluded by wishing prosperity to the British railways.

Mr. C. H. Ellison, the Senior Past President present, in an apt and interesting speech, thanked the L.N.E.R. for the facilities granted to members, also the committee for the work done in arranging the meeting. He referred in eulogistic terms to the devoted service given to the institution by Mr. Tweedie, who, he recalled, had become Secretary during his year of office as President.

In the afternoon, the International Exhibition was visited by coach and, although time was short, much of interest was seen, including the railway exhibits. The party then proceeded to Ostend. On the Sunday and Monday excursions were made to various places of interest in the surrounding districts and the meeting terminated on June 25, when the last of those not staying for holidays returned to London after a most enjoyable visit.

L.N.E.R. London Suburban Electrification

On Monday last Col. H. H. Mauldin, Superintendent (Eastern Section), L.N.E.R., outlined to a gathering of press representatives the company's plans for electrifying Liverpool Street suburban services with its share of the Government-guaranteed £35,000,000 improvements loan. It was hoped, he said, to electrify all lines to Shenfield, and at the same time to instal colour-light signalling controlled from all-electric boxes similar to that recently brought into use at Fenchurch Street station (described in THE RAILWAY GAZETTE of May 17 last). He estimated that these measures would improve the Ilford line services by 12 to 15 per cent. at the morning and evening peak hours, by at least 33⅓ per cent. over the peak periods, and by more than 50 per cent. on the whole day.

Even so, Col. Mauldin considered there would be some crowding at the worst of the rush hours; what the company really wanted to do was to provide another pair of lines from Liverpool Street to Stratford, but that was at present impracticable. Some of the relief to be expected from such widening would, however, be experienced if the Central London tube was extended to Stratford, whence the trains could run forward over the electrified L.N.E.R. lines.

Col. Mauldin made it clear that by "overcrowding" he meant any excess of passengers over seats, and claimed that such conditions did not exist on the Chingford and Walthamstow services. Even here passengers failed to make full use of the accommodation provided by concentrating themselves in those parts of trains which pulled up nearest the station exits. The same habit aggravated conditions on the Ilford line.

The Welwyn Garden City Collision

The facts that led up to the collision of June 15 at Welwyn Garden City, L.N.E.R., were inquired into on behalf of the Ministry of Transport, by Colonel Mount, the Chief Inspecting Officer. It will be remembered that the second portion of the 10.45 p.m. express from King's Cross to Newcastle, which throughout the evidence was referred to as the 10.53, was caught up and run into by the 10.50 parcels train, which left King's Cross at 10.58 and also carried passengers. That was done in order to take the passengers for Leeds and the West Riding off the 10.53. Both trains were running on the down fast line, and the collision took place opposite the signal box. Thirteen passengers and the guard of the 10.53 were killed. It is believed that all these unfortunate people were riding in the last coach of that train—a brake third. Most of the injured, of which there were not many, were in the third vehicle on the parcels train.

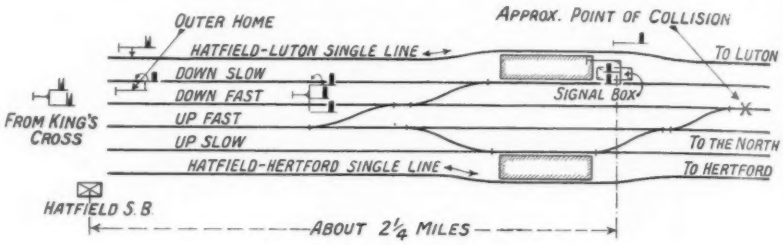
The inquiry was held in the ballroom of the Cherry Tree Hotel, and among the L.N.E.R. officers present were: From the Traffic Operating Department, Messrs. V. M. Barrington-Ward, F. Warriner, A. M. Creasey. From the Chief Mechanical Engineer's Department, Mr. H. N. Gresley. From the Locomotive Running Department, Mr. I. S. W. Groom. From the Engineer's Department, Messrs. J. C. L. Train, C. F. Slade, C. Carslake. At the beginning of the proceedings, Colonel Mount said that he had been asked to express the Minister of Transport's sympathy with the relatives of those who had lost their lives, and with those who had been injured in the accident. Proceeding, Colonel Mount reminded those present of the purpose of such inquiries. His investigation that day was in no way a court to determine any legal responsibility, but had for its object a search into the technical aspect of the accident, in order that the Minister of Transport might be advised of the cause, and recommendations made as to measures which might be adopted to avoid a recurrence. There might later arise the question as to whether some of the witnesses should be heard in private. The object for so doing would be to obtain the frankest statements possible on those points where a witness might be apprehensive that what he would otherwise have to say in public might prejudice him in the event of any subsequent legal inquiry.

Mr. Barrington-Ward, being called upon to make a statement of the events that led up to the accident, expressed, first, the sympathy of the Chairman and Directors with those who suffered as a result of the events; in that expression the company's officers and staff joined. He would also say how grateful the company was for the assistance rendered by medical men, ambulance workers, nurses, police and the public. Having related the destinations of the two portions of the 10.45, and why the parcels train—which always conveyed some local passengers—was on this occasion carrying passengers for Leeds, Mr. Barrington-Ward said that the collision occurred at or about 11.28. By 11.29 a taxi-cab driver, who was outside the station, saw what had happened and gave an emergency call from a telephone booth for ambulances and assistance. The stationmaster was called by a porter who was on duty, but he had heard the sound of the collision and was on the scene in four minutes. The Welwyn Garden City ambulance arrived within ten minutes, which was a smart piece of work. There were soon four motor ambulances at the scene, and all the equipment was taken from the two trains and from a local train in the station. Then a special train, with medical assistance from the Royal Free Hospital, arrived from London at 1.14. It could not be said that there was a shortage of help of that sort. There had, however, been a complaint as to insufficient lighting, but Mr. Barrington-Ward showed that that was not so. The electric lights in the station were on; some of the carriages remained lit; emergency lamps were taken from the trains; the station hand lamps numbered 20; and the police and fire brigade made full use of their own electrical apparatus. Flares were brought by men from the outlying districts. Traffic was diverted through Cuffley, and the lines were cleared by 4.30 on Sunday afternoon, 19 hours after the collision. The stationmaster, who was the first witness, said that the first ambulance was got away at 11.45 and the last at 1 a.m. The lighting was, in his opinion, adequate, but there was a rainstorm, and it was occasionally dark in the station.

Mr. Gresley handed in diagrams showing the composition, weights, &c., of both trains. The 10.53 was drawn by a 4-4-2 engine, No. 4441, and consisted of 11 bogie coaches, all having steel underframes, teak bodies, buckeye couplers, and the Pullman vestibule. The engine and tender weighed 112 tons, and the total weight of the train was 483 tons. The last vehicle—a brake third—bore the brunt of the collision; the whole of the underframe was compressed—"concertinaed"—into a small space and "embraced" the front end of the engine of the parcels train. The body of the last coach was broken into pieces. After the collision this destroyed vehicle was separated from the rest of the train and the next coach—the tenth on the train—went on with the remainder until the train came to rest about 120 yd. from the point of collision.

Mr. Gresley then related the remarkable experience of the second coach from the rear, and this led up to a statement as to the use of the buckeye coupling. Incidentally, the impact that the rear vehicle had to endure separated the two parts of the coupling that joined it to the next—*i.e.*, the coupling between the tenth and the eleventh vehicles. The collision knocked both bogies from under the tenth coach, and so it had neither bogie nor wheels. It turned on its side, but the coupling held and the carriage remained suspended and attached to the ninth carriage. There were no fatalities, and all the passengers escaped through the doors, which were nearly facing the sky. Beyond those two vehicles, there was no damage to the rest of that train. That was entirely due to the heavy steel underframes and the buckeye couplings. Answering Colonel Mount, Mr. Gresley said that he had not the slightest doubt that but for the buckeye coupling considerably more damage would have been done. Not only did he say that from his present experience, but from what previous accidents had shown,* Mr. Gresley added that if the last vehicle had had a body made of steel panels, instead of teak, it could not possibly have withstood the shock, as the steel panels are thin and would have crumpled up. Steel plates, 1⅛ in. thick, on the front of the locomotive of the parcels train, had been crumpled up as a result of the collision. The buckeye coupling was introduced on the East Coast stock in 1900, and adopted by the L.N.E.R. after grouping in 1923. There still remained a considerable proportion of the older stock that had not been equipped with the buckeye coupling. All the coaches on the 10.53 were lighted electrically.

Coming to the parcels train, Mr. Gresley said that it, too, had 11 bogie vehicles. It was drawn by 2-6-0 engine No. 4009, and the total weight was 394 tons 11 cwt. The first three vehicles were of modern construction, with steel



Sketch plan of Welwyn Garden City station layout

* See Editorial Note on page 1239.—ED. *R.G.*

underframes and buckeye couplers. They were followed by three vans, built in 1900 and 1902, with wooden underframes and gas lighted. The seventh vehicle was a modern coach with steel underframe, but as it was a compartment and not a corridor vehicle, it had neither Pullman vestibule nor buckeye coupling. The remaining three vehicles were brake vans, the last two of which were undamaged.

Because the third vehicle was followed by an old type of van, the two had to be coupled together by a screw coupling, thus there was nothing to keep the fourth vehicle in alignment and its leading end mounted and telescoped into the rear of the third coach. The seventh coach, because, though of modern construction, it had neither buckeye coupling nor Pullman vestibule, was badly damaged in the rear by the van that followed it.

To sum the whole matter up, Mr. Gresley said that the vehicles connected by the buckeye coupling remained coupled; in those with screw couplings the coupling was severed. On the question of all-steel coaches, he said that they had a few running. As he had already testified, it was his opinion that if the last coach on the 10.53 had had a steel-panelled body it would have "concertinaed" far more readily. The panelling was very thin, and it could not possibly stand the shock of a 120-ton locomotive running into it at high speed. They depended entirely upon the underframes, which are made very heavy and very strong. With the buckeye coupling, the whole of the shock was taken on very large indiarubber springs, and undoubtedly they absorbed a good deal of the shock.

Driver Morris, of the parcels train, said that his train passed through Hatfield at a speed of 65 to 70 m.p.h., and he sighted the Garden City distant at roughly 400 yd. distance. It was "on," so he gave a long whistle, shut off steam and passed it in the "warning" position. The home signal was at "clear" when he saw it from some 200 yd. away, so he whistled a short acknowledgment. He was about 300 yd. from the starting signal when he saw it as "clear"; that would be at the London end of the station, and he then whistled again. He was travelling at about 25 m.p.h. when the collision occurred. It was drizzling at the time and was a dark night. The visibility was not good—about 500 or 600 yd. Fireman Glenn gave similar evidence to that of his driver.

The remainder of the evidence was then given in private.

Forthcoming Events

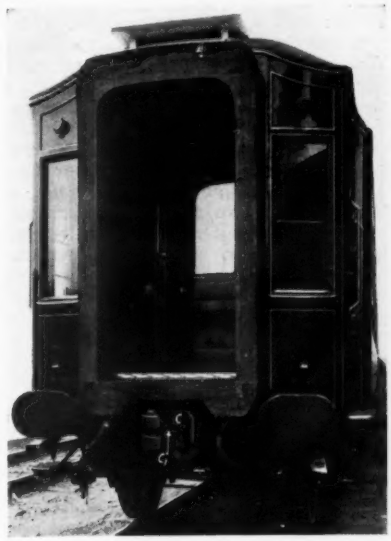
July 5–8.—Institution of Locomotive Engineers, in Belgium. Summer Meeting.

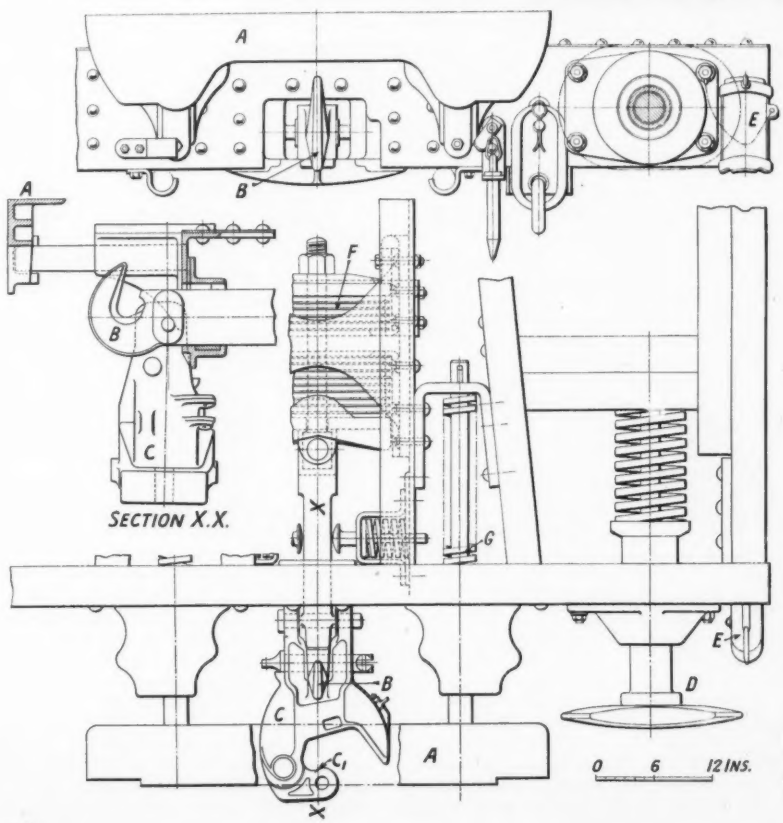
July 6–11.—**Permanent Way Institution, at Glasgow. Summer Convention.**

July 9 (*Tues.*)—Retired Railway Officers' Society, at Great Eastern Hotel, Liverpool Street, London, E.C. 2, 2.30 p.m. Ordinary Meeting.

Buckeye Couplers on the L.N.E.R.

Automatic buckeye couplers have been fitted as standard to all L.N.E.R. vestibuled carriages since 1923. Previously the fitting was standard on East Coast Joint Stock and Great Northern carriages, having been introduced in 1896. It is also standard on Pullman cars. The coupler, shown in the accompanying illustrations, consists of a large steel casting, C, with a moving jaw of cast steel, C1. When the couplers on adjoining vehicles are brought together, the jaw, C1, on each closes and the two couplers are securely locked in position by means of a steel bolt which falls into position as soon as the jaws have engaged. The draw and buffing forces on the coupler are transmitted directly to a set of large indiarubber springs, F, which will withstand a pressure of 50 tons when compressed 1½ in. and 100 tons when compressed 2 in. When the automatic coupler is in use the ordinary side buffers, D, are not required and are pushed back. When the carriage is to be coupled to another vehicle not equipped with the automatic coupler the latter is dropped to the vertical position and the ordinary drawhook, B, is brought into use. At the same time the buffers, D, are pulled out and the collar E placed over the buffer piston to hold the buffer face out at the normal distance from the carriage. In addition to the automatic coupler, the L.N.E.R. vehicles are provided with Pullman vestibules which consist of a large faceplate, the bottom section of which is shown at A on the drawings, having an indiarubber diaphragm to connect it to the body of the carriage. The vestibule is supported by steel piston rods having large steel springs, two of which are built into the carriage underframe (at G) and one into the end of the carriage roof. These springs assist in absorbing buffing shocks.





PARLIAMENTARY NOTES

The London Transport Scheme

In the House of Commons in Committee on June 21, consideration was given to a financial resolution required as preliminary to legislation in connection with the recently announced scheme of railway development in and near London.

Mr. Chamberlain (Chancellor of the Exchequer), in moving the resolution, said that the agreement between the parties had been initialled on June 18, and it was signed on June 20. The terms of the agreement were issued as a White Paper on June 18. The resolution which he was now moving authorised the introduction of the necessary Parliamentary Bill. That Bill would contain only two operative clauses, the first of which would authorise the Treasury to guarantee the payment of the principal and interest on securities to be issued by a company to be formed by the Treasury, which company was to issue securities up to an amount not exceeding £40,000,000. The same clause gave authority for the authorisation of payment out of the Consolidated Fund of any sums required for fulfilling the Treasury guarantees, and also for the receipt by the Exchequer of any money received by the Treasury by way of repayment. The second clause of the Bill would exempt from stamp duty the agreement and certain of the subsidiary agreements. Under the scheme there would be two transactions, first the issue of the securities by the company, and second the issue of securities by the undertakers as collateral security for the money which they would borrow from the company. It would be unreasonable to ask the transport undertakers to pay stamp duty twice over. Accordingly exemption was given by the second clause. That did not mean however that the securities to be issued by the company would not pay the ordinary loan capital duty amounting to 2s. 6d. per £100. At the end of the guaranteed term capital duty at the rate of 6d. per £100 would also be payable by the transport undertakings on the issue of stock in conversion of the original securities.

The transport undertakings would also require to introduce legislation to enable them to give effect to the scheme. The London Passenger Transport Board already had a private Bill before Parliament which covered extensive schemes of work, but it was not sufficient. The new Bill which they would promote would deal with financial matters and would enable the Board to utilise under the agreement other work which Parliament had already authorised or which it would shortly authorise. If the Board's new Bill were to follow the usual procedure for private Bills, it would be impossible to get it through before Parliament rose. The Government accordingly proposed that the Parliamentray Standing Orders should be modified so as to allow some of the formalities to be dispensed with. Notice had been given of a motion for the purpose. As in the case of all private Bills, however, petitioners would have ten clear days after the first reading of the Bill within which to deposit petitions against the Bill. The procedure motion followed previous precedents.

In regard to the proposed maximum loan of £40,000,000, instead of £35,000,000 (the estimated cost of the works), the agreement gave power to charge to capital all interest on the borrowings during the years of construction. Therefore they had to allow the interest during these years to be added to the capital sum. There were also incidental expenses which could only be charged to capital account. The prospectus would contain a provision giving the company the option to redeem the securities at a date prior to the final maturity of 25 years. On the general subject, he thought agreement had been reached with speed and smoothness. He would like to pay a tribute to Lord Ashfield and his colleagues for the spirit of co-operation in which they had approached the negotiations. They had shown regard not only for their shareholders but for the whole public. The Government attached much importance to the scheme. It would remove great inconvenience to travellers and would lead to the rapid development of the districts to be served. The programme also must mean the placing of very large orders with firms all over the country, and also preference to firms in the special areas. The fact that the Government had been able to bring to a satisfactory conclusion the arrangements for this great enterprise afforded an illustration of the benefits of the Government policy of cheap money. He had repeatedly stated that there were public works of a certain character and that there were many conditions in which the stimulation of such works by the Government could properly and usefully be undertaken, and that it was part of the policy of the Government to take such opportunities when they could find them. He hoped that the present scheme would herald from time to time the initiation of other schemes of the same character and equally valuable for industry and for employment.

Mr. Lansbury (Bow and Bromley—Lab.) congratulated the Chancellor of the Exchequer, and considered that the Government were stealing a little of the thunder of the various schemes of the late Labour Government.

Mr. John Rutherford (Edmonton—U.) urged the need of more railway facilities in the area which he represented, and other adjoining areas.

Mr. McEntee (Walthamstow W.—Lab.) pressed the need for improved facilities on the line from Liverpool Street to Walthamstow and Chingford.

Sir R. Glyn (Abingdon—U.) pointed out, in reply to other criticisms, the great improvements which had been made on the North London Railway services.

Sir G. Hamilton (Ilford—U.) thanked the Government for what his constituents would receive under the scheme. He anticipated growing prosperity for the railway companies as the result of the whole scheme. He also paid a tribute to Lord Ashfield and Sir Ralph Wedgwood for helping to bring the whole present proposal to a head.

Mr. Summersby (Shoreditch—Lib. Nat.) said he did not think that there was another part of London which had suffered more terribly from the lack of adequate transport facilities than Muswell Hill. He also considered that if the Transport Board dealt with cross-country services, they would gain a tremendous revenue.

Sir W. Sugden (Leyton W.—U.) submitted that there were no constituencies in the south of England that required more immediate attention in respect of transport than Leyton.

Mr. Duff Cooper (Financial Secretary to the Treasury), replying to the debate, referred to various complaints about railway services, and said he had a communication from the chief general manager of the London & North Eastern Railway to the effect that the situation regarding Enfield and Tottenham would receive consideration as soon as the development at present in hand had made progress.

The resolution was unanimously agreed to.

In the House of Commons, on June 24, at the time of Private Business, Mr. Baldwin, Prime Minister, moved a resolution making changes in the House's standing orders relating to private Bills, so far as the proposed London Passenger Transport Board (Finance) Bill is concerned. The dates for the various steps in connection with private Bills which are introduced at the beginning of the session are by the resolution altered in the case of this Bill in view of the fact, that this Bill is only now going to be introduced. The petition for and a copy of the Bill are to be deposited in the Private Bill Office, on or before June 27, and provisions are made for the subsequent steps to be accelerated, with the object of allowing the Bill to be passed in the present session.

The resolution was unanimously agreed to without discussion.

Just before the adjournment, on June 24, the House agreed to a resolution headed "London Passenger Transport (Agreement) [Money]" which had been reported from the Committee on June 21. A Bill was ordered to be brought in upon the said resolution, entitled "London Passenger Transport (Agreement) Bill—" to authorise the Treasury to guarantee securities issued in accordance with a certain agreement made on June 20, 1935, and to exempt the said agreement and certain other agreements from stamp duty." The Bill was presented and read the first time, and was to be read a second time yesterday (Thursday).

QUESTIONS IN PARLIAMENT

South-East London Facilities

Mr. George Strauss, on June 18, asked the Minister of Transport whether under the proposed London Passenger Transport improvement schemes, regard would be had to the claims of the South-Eastern district of London for greater tube facilities.

Captain A. Hudson (Parliamentary Secretary) replied.—The electrification of the Southern Railway has improved the travelling facilities in South and South-East London, and the London Passenger Transport Board has informed me that in these circumstances it considers that other areas not so well served are more in need of improvement.

Possible Electrification in Yorkshire

Sir Arthur Shirley Benn, on June 19, asked the Minister of Transport whether he would invite the London Midland and Scottish and the London and North Eastern Railway Companies to initiate a joint investigation of their lines in the West Riding, North Derbyshire, and North Nottinghamshire, with a view to early conversion under a similar guarantee to that just promised by the Government in the London transport area.

Mr. Hore-Belisha.—I have been in communication with the two railway companies mentioned, and am informed that as regards the West Riding of Yorkshire a joint examination is being made by them of the possibilities of railway electrification, but as regards Nottinghamshire and Derbyshire, it is considered that these areas do not afford scope for any remunerative scheme of this nature. The initiative for submitting schemes for the consideration of H.M. Government naturally rests with the undertakings concerned.

Highgate Facilities

Mr. Oswald Lewis, on June 25, asked the Minister of Transport if one of the conditions of Government assistance in the extension of the tube railway from Highgate would be the provision of a tube station in Highgate village and the consequent abolition of the present tramway service up Highgate Hill.

Captain A. Hudson replied.—The details of the scheme for extending the tube railway from its present terminus under Junction Road to East Finchley by way of Highgate station on the L.N.E.R. have not yet been fully settled; but I am informed that it would not be practicable to include a station at Highgate Village owing to the depth of the railway below the surface, and the need for avoiding sharp curves in the tracks.

An Iraq Railway Rumour

Mr. Wedgwood asked the Secretary of State for Foreign Affairs what steps he was taking in regard to the projected railway to connect the two ends of the Baghdad-Alexandretta Railway, in view of its damaging effect on the Haifa pipe-line and the prospects of a future Haifa-Baghdad Railway.

Colonel Colville (Secretary, Overseas Department) replied.—I presume that the right hon. gentleman has in mind a recent press report to the effect that the British Oil Development Company is proposing to build a railway in Iraq to link up the area of its concession with the existing railway from Aleppo. If so, he will no doubt have observed that the secretary of the company subsequently declared—in a statement which appeared in the *Times* of June 20—the information given in the press message to be premature and inaccurate. I am not in a position to supplement or comment upon the information which has appeared in the press.

The Part the Poster Plays in Advertising

Mr. C. Grasemann, Public Relations and Advertising Officer, Southern Railway, said in a speech at the second general session of the Advertising Association Convention at Torquay on Monday, that the part legitimately played by the poster in advertising varied considerably, quite apart from any illegitimate or prejudicial uses to which it might be put. Dealing with the legitimate or reasoned use of posters, it was found, in the first place, variation in the amount of their particular use is attributable to the commodity which has to be advertised. A commodity with a simple name or slogan, such as Bovril, was particularly suitable so far as poster advertising was concerned, as it was able to accommodate itself to the primary functions of a poster, which were brevity and simplicity. Such commodities could, with perfect confidence, undertake the complete scheme of publicity by means of posters alone.

In the case, however, of commodities requiring details to be mentioned in their salesmanship the poster became complementary to other means of advertising, such as press and pamphlets. It was not generally realised that the accepted value of posters was for various reasons lower than their intrinsic or actual value, due to the fact that they did not enjoy the same opportunities of showing their value as did media such as the press.

For this reason, the poster was in the happy position of starting with a distinct advantage over most forms of advertising in that it was, comparatively speaking, cheaper. In a test made in conjunction with a resort a few years ago, a poster was keyed, in the same way as a newspaper advertisement, and it was found that one and a half actual postal inquiries were received per poster. Remembering that a poster is primarily produced to deliver a message quickly and shortly, the result was far more than was expected, and proved to be a very cheap form of salesmanship.

In order that the actual value of a poster can be obtained in any publicity scheme, it was necessary that the correct type of poster should be used. Different types of posters could be briefly grouped into three categories :—

1. Pictorial only.
2. Letterpress only.
3. Joint pictorial and letterpress.

Probably the most generally suitable was the last named, and in carrying out publicity campaigns himself in which press, poster, and pamphlet advertising by means of post and house-to-house distribution had been employed, Mr. Grasemann said he had used one design running through the whole campaign. At the moment the Southern Railway's electrification to Eastbourne and Hastings, which would be inaugurated early next month, was being carried out on those lines, the design of a hand pointing at the live electric rail running through every means of publicity.

By this means far greater cumulative effect resulted than would be possible if all these different forms of advertising media were designed, created and produced separately, and this showed just the part the poster really should play in an advertising scheme.

He often felt that advertising agents had not kept pace with the co-operative spirit of the times, and had not linked up the various media of advertising to a sufficient extent. So often one found a campaign entirely confined to newspapers or the post, and occasionally only confined to posters or display in one type of place. While it was admitted that this was logically correct for certain commodities, Mr. Grasemann felt sure that had more welding of the different advertising media been carried out, the industry as a whole would have benefited, for, instead of robbing each other, the different media would have helped to sell each other. Only the advertising agent could accomplish this, as it was very rare to find that the people who owned newspapers owned poster sites, and, of course, it was impossible for them to have financial interest in the Post Office.

Concluding, Mr. Grasemann said that the poster had a very definite part to play in every advertising campaign, and in view of its comparative cheapness, should never be overlooked. On the other hand, he would hesitate very much, except in the case of a few commodities, before advising anyone to put all his advertising appropriation into a campaign where only posters were used.

NOTES AND NEWS

London Transport Board (Finance) Bill.—A Parliamentary Notice was published on June 25 of the Finance Bill to be promoted by London Transport in connection with the Government's London suburban electrification and extension scheme.

New Postal Sorting Carriages for London-Aberdeen Service.—For the postal expresses between London and Aberdeen, the L.M.S. has just built at Wolverton works three new Post Office sorting carriages equipped for picking up and delivering mails at speed, and for sorting letters *en route*. Each vehicle is 60 ft. long.

Electrical Engineers' Conversazione.—The annual conversazione of the Institution of Electrical Engineers was held at the Natural History Museum on June 20, when the President, Professor W. M. Thornton, and Mrs. Thornton, received a large gathering of guests. Music was provided by the string band of the Royal Engineers, and Frank Phillips, Eda Kersey, Garda Hall, and Solomon were among the artistes taking part in a concert.

Road Accidents.—The Ministry of Transport return for the week ended June 22 of persons killed or injured in road accidents is as follows. The figures in brackets are those for the corresponding period of last year:—

	Killed, including deaths resulting from previous accidents	Injured
England ...	... 97 (114)	3,965 (4,474)
Wales ...	... 6 (3)	188 (214)
Scotland ...	... 15 (16)	437 (450)
	118 (133).	4,590 (5,138)

The total fatalities for the previous week were 115, as compared with 142 for the corresponding period of last year.

Buenos Ayres & Pacific Moratorium.—Meetings of the holders of all debenture stocks, other than first debenture stocks, in the Buenos Ayres & Pacific and Argentine Great Western Railway Companies, approved on June 24, by large majorities, a scheme proposed by the directors for an extension of the moratorium which has since 1932 applied to the interest on the stocks concerned. An extension of the moratorium to June 30, 1935, had already been sanctioned, and the scheme now sanctioned extends the moratorium for another year at least, with power for the stockholders' committee to extend it up to June 30, 1938.

Progress of Railway Bills.—The Southern Railway Bill and the London & North Eastern Railway Bill, which have already been through the House of Commons, were, on June 25, reported for third reading in the House of Lords by the Unopposed Bills Committee of that House. In the Southern Bill amendments were made, but the L.N.E.R. Bill was unamended. The London Midland & Scottish Railway Order Confirmation Bill relating to Scotland was passed through the first and second reading and report stages in the House of Lords on June 25. The London Passenger Transport Board Bill, which has already been passed by the House of Commons, was read a second time in the House of Lords, on June 24 and committed. Eight petitions have been deposited against the Bill, of which one is by the Abbey Road Building Society and five are by local authorities.

"Safety First" Awards for L.N.E.R. Drivers.—Three L.N.E.R. drivers received special bars for 15 years' freedom from accidents, and 28 were awarded gold medals for 10 years' immunity, when the presentation in connection with the 1934 "Safety First" competition took place at the Guildhall on June 19. The Lord Mayor of London presided, supported by the sheriffs and the Rt. Hon. Lord Ebbisham, President of the "Safety First" Council.

Ottoman Railway from Smyrna to Aidin.—Special general meetings of the shareholders and debenture holders of the Ottoman Railway from Smyrna to Aidin were held on Wednesday at Winchester House, London, E.C., at which the agreement for the sale of the line dated May 1, 1935, made between the Government of the Turkish Republic and the company, was approved unanimously and duly ratified. The Chairman, Lord St. Davids, announced that the scheme of arrangement dated May 22 was duly sanctioned by the Court on June 24; also that the scheme will become operative as soon as the £1,825,840 7½ per cent. Turkish debt bonds 1935 shall have been deposited with the Ottoman Bank in London. By the agreement this is to take place not later than September 30, 1935. He further announced that the Grand National Assembly of Turkey had duly ratified the sale agreement on May 30, 1935.

Southern Electrification Signs.—In connection with the extension of the electric services to Eastbourne and Hastings, which come into operation on July 7, a large number of new enamel signs have been erected for the purpose of guiding passengers to the stations and notifying them of relevant facts thereat. These signs accord with the company's latest standards, having white lettering on a green background. In addition, standard station name boards and lamp plates have been fixed and post boards and frames renovated. The company has also issued a free pocket timetable of the London-Hastings and Hastings-Brighton services, together with connections from Victoria and London Bridge to Horsted Keynes via the electrified extension from Haywards Heath. A very legible type, boldly printed references with the relevant notes appearing at the bottom of each page, and the use of pleasantly tinted ink, dispel the usual monotony of timetable pages, while the front cover bears the familiar design now standardised by the Southern Railway for announcements relating to electric services. Season and cheap ticket rates are shown in the booklet.

L.M.S.R. Preference Stock.—The directors at their meeting on Wednesday had under consideration the payment of an interim dividend on the 5 per cent. redeemable preference stock (1955), due in the ordinary course on July 1; and, having regard to the fact that the stock ranks *pari passu* with the company's 4 per cent. preference stock, they decided to follow the course adopted the last two years, and defer the matter until their meeting on July 25, when the traffic results for the full half year will be available.

Naming of L.N.E.R. Locomotive "Suffolk Regiment."—To commemorate the 250th anniversary of the Suffolk Regiment, this name was given on June 22 to the L.N.E.R. locomotive No. 2845 of the new B.17 class. The first part of the ceremony took place at Ipswich, where, after a speech by Mr. William Whitelaw, Chairman of the company, the nameplates of the engine were unveiled by Major-General Sir John Ponsonby, K.C.B., C.M.G., D.S.O., Colonel of the Suffolk Regiment. The engine afterwards proceeded to Bury St. Edmunds at the head of a special train conveying guests, and was there received by a military guard of honour and by the Mayor and Corporation. Sir John Ponsonby then placed the regimental badge in position on the engine and presented souvenirs of the event to the driver and fireman. The following represented the L.N.E.R. at the ceremonies: Mr. William Whitelaw (Chairman); Sir Gerald Talbot, Sir Charles Batho (Directors); Sir Ralph L. Wedgwood (Chief General Manager); Mr. H. N. Gresley (Chief Mechanical Engineer); Mr. I. S. W. Groom (Locomotive Running Superintendent).

Rail Tours for Industrial Congress.—In connection with the sixth International Congress for Scientific Management, to be held in London from July 15-20, two railway tours have been arranged to give delegates an opportunity of viewing a variety of well-managed British concerns. For this purpose two trains of first-class dining and sleeping cars have been reserved, each to convey a party of not more than 55 persons. The tours will each occupy a week, one covering Stratford-on-Avon, Manchester, the Lake District, Huddersfield, Nottingham and Northampton, and the other visiting Stratford-on-Avon, Dursley, Bristol, Birmingham, Stoke, Liverpool, Glasgow, Edinburgh, York, and Leeds. Both leave London on July 21 and return on July 27. Nights will be spent in the trains, and most meals served in the dining cars. The all-inclusive charge will not exceed £3 a day. For the convenience of delegates attending the congress, reductions in return fares of from 33 to 50 per cent. are being granted by British and many Continental railways. Plenary sessions

of the Congress will be held at the Central Hall, Westminster, where the Prince of Wales will open the proceedings at noon on July 15, and group sessions to receive and discuss reports at the Institution of Civil Engineers and the Institution of Mechanical Engineers. The congress is sponsored by the Federation of British Industries, whose offices are at 21, Tothill Street, S.W.1.

British Standards Institution.—The annual meeting of the British Standards Institution was held at the Institution of Mechanical Engineers, Storey's Gate, S.W.1, on May 28. Dr. E. F. Armstrong, F.R.S., who presided, said, in presenting the report on the year, that marked progress had been shown in all sections. Of particular note was the fact that over 150,000 copies of the British Standard Specifications had been sold and distributed, which was an increase of 23,000 over the preceding year. The total membership of the institution now exceeded 5,000, and there were 700 committees holding over 1,000 meetings annually. It was announced that Mr. W. Reavell, a past president of the Institution of Mechanical Engineers, had been elected Chairman of the General Council for the ensuing year. The meeting was followed by a luncheon at which Dr. Burgin, Parliamentary Secretary to the Board of Trade, referred in the course of a speech to the advantages resulting from the standardisation achieved by the institution. Manufacturers were now able to manufacture to stock, which was a great advantage to administration at a time when it was most desirable to take people off the labour market. The Rt. Hon. G. W. Forbes, Prime Minister of New Zealand, wished the B.S.I. every success in its valuable work, and said he hoped the newly-formed Standards Institution in New Zealand would grow in usefulness so as to take its place worthily along with other standardising bodies. His good wishes were suitably acknowledged by Dr. Armstrong, the retiring Chairman, and Mr. W. Reavell.

British and Irish Traffic Returns

GREAT BRITAIN	Totals for 25th Week			Totals to Date		
	1935	1934	Inc. or Dec.	1935	1934	Inc. or Dec.
L.M.S.R. (6,926¼ mls.)	£	£	£	£	£	£
Passenger-train traffic...	518,000	503,000	+ 15,000	10,736,000	10,493,000	+ 243,000
Merchandise, &c. ...	452,000	451,000	+ 1,000	11,139,000	11,135,000	+ 4,000
Coal and coke ...	207,000	178,000	+ 29,000	5,942,000	5,931,000	+ 11,000
Goods-train traffic ...	659,000	629,000	+ 30,000	17,081,000	17,066,000	+ 15,000
Total receipts	1,177,000	1,132,000	+ 45,000	27,817,000	27,559,000	+ 258,000
L.N.E.R. (6,336 mls.)						
Passenger-train traffic...	337,000	344,000	+ 3,000	6,999,000	6,808,000	+ 191,000
Merchandise, &c. ...	320,000	302,000	+ 18,000	7,674,000	7,754,000	− 80,000
Coal and coke ...	204,000	191,000	+ 13,000	5,663,000	5,810,000	− 147,000
Goods-train traffic ...	524,000	493,000	+ 31,000	13,337,000	13,564,000	− 227,000
Total receipts	861,000	827,000	+ 34,000	20,336,000	20,372,000	− 36,000
G.W.R. (3,749¼ mls.)						
Passenger-train traffic...	216,000	206,000	+ 10,000	4,446,000	4,397,000	+ 49,000
Merchandise, &c. ...	193,000	183,000	+ 10,000	4,483,000	4,461,000	+ 22,000
Coal and coke ...	95,000	85,000	+ 10,000	2,492,000	2,530 000	− 38,000
Goods-train traffic ...	288,000	268,000	+ 20,000	6,975,000	6,991,000	− 16,000
Total receipts	504,000	474,000	+ 30,000	11,421,000	11,388,000	+ 33,000
S.R. (2,171 mls.)						
Passenger-train traffic...	335,000	330,000	+ 5,000	6,700,000	6,567,000	+ 133,000
Merchandise, &c. ...	64,500	67,000	− 2,500	1,490,500	1,595,000	− 104,500
Coal and coke ...	24,500	24,000	+ 500	761,500	801,000	− 39,500
Goods-train traffic ...	89,000	91,000	− 2,000	2,252,000	2,396,000	− 144,000
Total receipts	424,000	421,000	+ 3,000	8,952,000	8,963,000	− 11,000
Liverpool Overhead ... (6½ mls.)	1,308	1,220	+ 88	28,292	27,588	+ 704
Mersey (4½ mls.) ...	3,761	3,958	− 197	100,986	103,701	− 2,715
*London Passenger Transport Board ...	546,200	547,100	− 900	27,449,100	26,877,700	+ 571,400
IRELAND						
Belfast & C.D. pass. (80 mls.)	2,688	3,120	− 432	50,758	50,367	+ 391
,, ,, goods	512	549	− 37	12,382	13,230	− 848
,, ,, total	3,200	3,669	− 469	63,140	63,597	− 457
Great Northern pass. (543 mls.)	10,750	11,400	− 650	223,350	205,900	+ 17,450
,, ,, goods	9,600	8,950	+ 650	226,150	217,600	+ 8,550
,, ,, total	20,350	20,350	—	449,500	423,500	+ 26,000
Great Southern pass. (2,124 mls.)	27,371	28,747	− 1,376	530,317	523,585	+ 6,732
,, ,, goods	31,838	31,265	+ 573	862,546	806,506	+ 56,040
,, ,, total	59,209	60,012	− 803	1,392,863	1,330,091	+ 62,772

* 51st week, the receipts for which include those undertakings not absorbed by the L.P.T.B. in the corresponding period last year; last year's figures are, however, adjusted for comparative purposes.

British and Irish Railways Stocks and Shares

Stocks	Highest 1934	Lowest 1934	Prices June 26, 1935	Prices Rise/Fall
G.W.R.				
Cons. Ord. ...	66½	48½	50	+½
5% Con. Prefce. ...	118	109	120½	+1
5% Red. Pref. (1950)	115	107	112½	—
4% Deb.	117	105	115*	−1
4½% Deb.... ...	119	109	115½*	−1
4½% Deb.... ...	129½	115¼	126½*	−1
5% Deb.	135	126¼	136½*	−1
2½% Deb.... ...	75	64	78*	−½
5% Rt. Charge ...	134 7/16	123¼	134½*	−1
5% Cons. Guar. ...	132¾	121¾	133½	+1
L.M.S.R.				
Ord.	30½	19½	20½	+1
4% Prefce. (1923)	64¼	41	57	+½
4% Prefce. ...	87	69½	81½	+½
5% Red. Pref. (1955)	107	92½	103½	+1
4% Deb.	114⅛	100½	106½	−½
5% Red. Deb. (1952)	118 11/16	111¼	115½	—
4% Guar.	106½	96¾	102½	−½
L.N.E.R.				
5% Pref. Ord. ...	24¾	13½	12½	—
Def. Ord.	11½	6⅞	6¼	—
4% First Prefce. ...	76	59½	65	+1½
4% Second Prefce.	47	25½	25½	—
5% Red. Pref. (1955)	94½	80	82⅛	+1
4% First Guar. ...	104	92	100½	—
4% Second Guar.	97⅞	86½	92½	—
3% Deb.	90	74½	81	−½
4% Deb.	114	99¼	106	—
5% Red. Deb. (1947)	117	108	113½	—
4½% Sinking Fund Red. Deb.	111¼	105¼	109	—
SOUTHERN				
Pref. Ord.... ...	90	63⅛	84	—
Def. Ord.	32⅝	19	23½	—
5% Prefce. ...	118 5/16	107½	120½	+½
5% Red. Pref. (1964)	115¾	107½	115⅛	—
5% Guar. Prefce.	132	120¾	132½	+1
5% Red. Guar. Pref. (1957)	119½	113	119½	+1
4% Deb.	116½	103¼	113	—
5% Deb.	134	124 13/16	133½	—
4% Red. Deb. 1962–67	113 11/16	105 9/16	111½	+½
BELFAST & C.D.				
Ord.	6	5	4	—
FORTH BRIDGE				
4% Deb.	110	100	107½	—
4% Guar.	110	100	107½	—
G. NORTHERN (IRELAND)				
Ord.	9¾	4 15/16	9	—
G. SOUTHERN (IRELAND)				
Ord.	25	12½	25	—
Prefce.	21½	13 15/16	38	—
Guar.	48	39	69	—
Deb.	67	59	79¾	+2¾
L.P.T.B.				
4½% "A" ...	126	115	124½	—
5% "A"	135½	124½	134½	—
4½% "T.F.A." ...	113½	107½	111	—
5% "B"	131¾	118	127½	—
"C"	97	73	99	−1
MERSEY				
Ord.	15¼	7	12	—
4% Perp. Deb. ...	93½	82½	95½	—
3% Perp. Deb. ...	66½	61½	69½	—
3% Perp. Prefce....	54	44½	52½	—

* ex-dividend

CONTRACTS AND TENDERS

Diesel Railcars for G.W.R.

The Associated Equipment Co. Ltd. has in hand an order from the G.W.R. for ten streamlined diesel railcars having twin A.E.C.-Ricardo engines and twin gearboxes, and generally similar to, but with several minor improvements over, the diesel railcars already in service on this railway. This order for ten cars, which was recorded in this column in our March 1, 1935, issue, when completed will bring the total number of diesel railcars, all by the same maker, in service on the G.W.R. up to seventeen, made up as follows: one 130-b.h.p. railcar working between Slough, Reading, Didcot and Oxford (fully described in our *Diesel Railway Traction Supplements* for July 14 and November 3, 1933); three express twin-engined 260-b.h.p. railcars for express services between South Wales and the Midlands (fully described in our *Diesel Railway Traction Supplements* for June 15 and July 13, 1934); three further cars of the same type which, as mentioned in the last-named article, were then complete so far as chassis and power units were concerned, but were awaiting decision as regards body work until their duties were settled, and are now to enter service on July 8 (these cars have bodies similar to the first car); and finally the ten railcars, with the same size twin engines, and bodies also generally similar to the first car, now put in hand by A.E.C. Ltd. Wooden framed, steel panelled bodies, supplied by the Gloucester Railway Carriage & Wagon Co. Ltd., are being used for the latest ten cars and also for the second batch of three. One of these last-named cars is to work between Stratford-on-Avon and Birmingham. Certain minor modifications to the original design have been made in the thirteen new cars; the seating is practically the same as the first car, but sliding doors have displaced the folding arrangement; the upholstery is to be in G.W.R. standard moquette, and a feature which doubtless will be much appreciated by the passenger is the lowering of the window line by 6 in. at the waist and also improved ventilation arrangements. Three of the ten cars will each have a lavatory compartment, and another car of the ten, for experimental service, will have a parcels van body. It is expected that the first of the order for ten will be ready for service in October.

Pritchett & Gold & E.P.S. Limited has received an order from the Indian Stores Department for 120 lead plate cells at a total price of Rs. 11,880.

The Hunslet Engine Co. Ltd. has received an order from the Bhavnagar State Railway Administration for two boilers for large F class metre-gauge locomotives, to the inspection of Messrs. Robt. White & Partners.

The Bhavnagar State Railway Administration has also placed the following orders to the inspection of Messrs. Robt. White & Partners:—G. H. Sheffield & Co. Ltd.: two four-wheeled Sheffield-Twinberrow bogies for metre gauge; and A.B.C. Coupler Co. Ltd.: 47 M.C.A. P.H. type buffers with hook and screw coupling.

The Associated Equipment Co. Ltd. has received a repeat order from the London Passenger Transport Board for 200 oil-engined Regent passenger vehicles and also a repeat order from the Crown Agents for the Colonies for an oil-engined eight-wheeled tractor for service in Tanganyika.

Locomotives Required for South Africa

Inquiries have been issued by the South African Railways & Harbours Administration for four NG/G.13 class Garratt articulated locomotives having the 2-6-2 + 2-6-2 wheel arrangement and designed for service on the 2-ft. gauge. These engines are to have cylinders 12 in. diam. by 16 in. stroke, coupled wheels 2 ft. 9 in. diam., and boiler pressure 180 lb. per sq. in. With a maximum individual axle load of 7 tons, they are to develop a tractive effort of 18,850 lb. at 85 per cent. boiler pressure.

British Timken Limited has recently secured orders for railway axleboxes and bearings for Belgian and South African rolling-stock.

Locomotives for China

The Skoda Locomotive Works and the Société Belge de Chemin de Fer en Chine (on behalf of Belgian locomotive builders) have each received orders for ten standard-gauge 2-6-2 locomotives and tenders, for the Peiping-Hankow Railway.

Fried. Krupp A.G. has received orders from the South African Railways & Harbours Board for spares required for 19C Class locomotives.

The South African Railways & Harbours Board has recently placed the following orders:—

Federated Engineers Limited and Tees Side Bridge & Engineering Co. Ltd.: Taper keys.

Chas. Richards & Sons Ltd. and Bayliss, Jones & Bayliss Limited: Heel and crossing bolts.

Bayliss, Jones & Bayliss Limited, S. A. Gilsoco, and Laminoris & Bouloneries de Ruan: Galvanised coach screws.

Railcar Engines and Torque Converters for New Zealand

Leyland Motors Limited has received an order from the New Zealand Government Railways for seven hydraulic railcar units, each to consist of engine and torque-converter, to form a unit assembly, and the controls and driving axle gearing. Six sets will incorporate 10-litre petrol engines and the remaining set will be fitted with a 10-litre oil engine. These units will be built into railcars to be constructed by the New Zealand Government Railways' own workshops and intended for service on the Rimutaka mountain range route where the steepest gradients vary from 1 in 14 to 1 in 12 and where there are five-chain radius curves. Special cooling systems suited to these conditions will be adopted both for the torque-converter fluid and for the engines.

The Egyptian State Railways Administration has placed the following orders:—

S. A. Ing. V. Tedeschi & Co.: Cables (Ref. E.S.R. 30.151, total price £1,276 10s. f.o.b. Genoa.)

Stahlunion-Export for August Thyssen: 710 metric tons screwspikes at L.E.9.100 mills per ton f.o.b. Antwerp. (Ref. E.S.R. 302G3/6D.)

P. & W. MacLellan: Mild steel plates. (Ref. E.S.R. 301G3/14, approximate cost £2,467, f.o.b. Glasgow, Hull or Middlesbrough.)

Kabel-Und-Gummiwerke A.G.: Cable. (Ref. E.S.R. 30.158, total cost £778 5s. f.o.b. Antwerp.)

The L.N.E.R. has placed contracts for the cleaning and painting of Fenchurch Street station, Marylebone station and goods depot and Liverpool Street station, respectively, with W. G. Beaumont & Son, Bow, E.3; Arundel (Contractors) Limited, Bradford; and C. & T. Painters Limited, Harlesden, N.W.10.

Railcars for Spain

A company is being formed in Madrid to finance the supply and operation of railcars for the Spanish railways, states *El Financiero*. This company, it is understood, will undertake to supply at once eighteen new railcars for the Northern Railway of Spain and also an important order for the M.Z.A. Railway. Three Spanish firms will probably be entrusted with the construction of these vehicles. Further details will be found in our Overseas Railway Affairs, Spanish section, in this issue.

It is announced that the Tasmanian Government Railways Administration is inviting tenders for two Q class 4-8-2 locomotives.

The Bombay Baroda & Central India Railway Administration invites tenders receivable at The White Mansion, 91, Petty France, Westminster, S.W.1, by July 12 for steel plates, angles and rounds.

The Chief Controller of Stores, Indian Stores Department (Engineering Section), Simla, invites tenders for materials for the East Indian Railway, receivable on the dates named, as follow:—200,000 m.s. solid cotters for c.i. sleepers (July 15) and 100,000 m.s. tie bars for broad-gauge sleepers (July 21).

Tenders are invited by the Egyptian State Railways Administration, receivable in the office of the Superintendent of Stores, Saptieh, Cairo, by July 20, for the supply of 70 metric tons of Whyte–Sandberg chrome-manganese rails.

The Hunslet Engine Co. Ltd., Leeds, has purchased the entire goodwill, including patterns, drawings, &c., of the Avonside Engine Co. Ltd., of Bristol, from the liquidator of that company. The Hunslet Engine Co. Ltd. will, in the future, conduct the business of the Avonside company at its own works in Leeds and will continue the valuable connection of that company both at home and abroad. As may be remembered, the Hunslet Engine Co. Ltd. similarly acquired the business of Kerr, Stuart & Co. Ltd., of Stoke-on-Trent.

OFFICIAL NOTICES

THE MADRAS & SOUTHERN MAHRATTA RAILWAY COMPANY LIMITED invite Tenders for :—

7 BOILERS FOR LOCOMOTIVES—METRE GAUGE, viz. :

4 Boilers for M.S. 4-6-0 Type Locomotives.
1 Boiler for Y.C. 4-6-2 Type Heavy Locomotive.
2 Boilers for Y.D. 2-8-2 Type Light Locomotives.

Specification and Form of Tender can be obtained at the Company's Offices, 25, Buckingham Palace Road, Westminster, London, S.W.1.

Fee ONE GUINEA *which will not be returned.*

Tenders must be submitted not later than 2 o'clock p.m. on TUESDAY, 16TH JULY, 1935.

The Directors do not bind themselves to accept the lowest or any Tender and reserve to themselves the right of reducing or dividing the order.

By Order of the Board.
G. W. V. DE RHE PHILIPE.
Secretary.

RAILWAY AND OTHER MEETINGS

MEXICAN RAILWAY CO. LTD.

The half yearly meeting of the Mexican Railway Co. Ltd. was held at Winchester House, Old Broad Street, E.C.4, on Wednesday, June 26, Mr. Vincent W. Yorke, Chairman of the company, presiding.

The Secretary, Mr. C. Tennant, read the notice convening the meeting and the auditors' report.

The Chairman, in moving the adoption of the report and accounts, said that the traffics for the second half of 1934 clearly reflected the improved financial conditions in Mexico. Exchange had been completely stabilised with the American dollar, and the low cost of living had brought about an increase in consumption. Labour unrest, however, was worse than at any time in the history of the country.

Despite competition from the roads and, in oil traffic, from a new pipe-line, passenger and goods receipts had increased by 15·4 per cent. and 21 per cent. respectively. Traffics as a whole were 18·6 per cent. up on the corresponding half year. Ton and passenger kilometrage rose by 11·9 per cent., but despite wage concessions the increase in expenses was restricted to 9·29 per cent.

This was the first occasion on which the Absentee tax had appeared in the accounts. It was levied at the rate of 4 per cent. on remittances from Mexico to non-residents, but should not, the Chairman considered, apply to payments in respect of debenture interest. This point was being taken up with the authorities.

Although gross receipts in the current half year showed satisfactory increases, a net revenue of more than about £33,000, or insufficient to meet the debenture interest, could not be anticipated. It would shortly be necessary to approach the debenture holders again regarding a renewal of the moratorium which expires early next year. These conditions resulted from the concession of 50,000 pesos a month to the men, a measure agreed to by the Chairman when he visited the country and found a strike on the railway imminent unless a settlement was reached.

Apart from the labour disputes in which every large enterprise was involved, he found living conditions much better than when he was there three years ago. The main line track of the railway, too, was in very fair order, but the locomotives, many of them 30 to 40 years old, were deficient in power for modern traffic and required constant attention in the shops. He estimated that an expenditure of some £110,000 on new engines would be necessary in the near future. About £25,000 had been spent on new freight cars, and the renewal of workshop equipment could be estimated as entailing a further £20,000. These sums aggregated nearly £200,000 to be spent within the next two years if the railway was to be worked with any regard to efficiency and economy. At the present rate of business the company would require nearly three years' earnings to pay for this equipment, during which time there would be no margin for interest of any sort to the debenture holders.

Similar conditions faced all foreign business in Mexico. Although the depreciation of the peso had benefited the country internally in some ways, renewals of industrial equipment entailed fabulous expenditure in currency. Meanwhile the trade unions refused to recognise the right of capital to its reward and brought constant pressure to bear on the company. There had, however, been some very recent changes in the Mexican Cabinet which might result in the claims of industry being more fairly heard. A more equitable outlook on labour questions and an increase in railway rates would do much to help.

The company was now resisting further concessions to its employees, and in view of the present scales of pay and the purchasing power of the peso, it did so with a clear conscience. A telegram from the General Manager reported that progress in the discussions with the labour unions was slow, but its tone was otherwise fairly encouraging. Crops were better than last year, and local passenger traffic showed improvement. The company was, however, hampered by a shortage of rolling stock in organising excursions.

The report and accounts were unanimously adopted.

High Speed in Belgium

Some further remarkable quickenings of service have taken place this summer on the Belgian National Railways, especially between Brussels and Ostend. Over the new line between Brussels (Midi) and Ghent, the quickest time for the 33·4 miles has been pared to 32 min. in each direction, giving a start-to-stop speed of 62·7 m.p.h., and six trains daily in each direction are so scheduled. In addition, four trains make the Ghent-Brussels journey in 33 min. (60·7 m.p.h.) and six run from Brussels to Ghent in 34 min. (58·9 m.p.h.). Between Ghent and Bruges, 26 min. remains the fastest time for the 26·5 miles, from start-to-stop, but seven trains are now so booked, at 61·2 m.p.h., from Ghent to Bruges, and three are timed in the reverse direction in 27 min (58·9 m.p.h.). A very fast run is made by the 8.32 a.m. from Bruges to Brussels (Midi), which covers the 59·9 miles non-stop in 58 min., at 61·9 m.p.h. ; and there are two runs booked over the 72·1 miles between Ostend and Brussels in 74 min., one in each direction. Notable accelerations have taken place over other routes. Luxembourg, 141 miles from Brussels by the extremely difficult route through the Ardennes, has been brought within 3 hr. of the capital, inclusive of a 5 min. stop at Namur, by the Edelweiss Pullman express. Actually, the times are 3 hr. 1 min. from Brussels to Luxembourg, and 2 hr. 58 min, in the reverse direction. Most notable are the timings between Namur and Luxembourg, the run of 102·5 miles—the only non-stop journey in Belgium exceeding one hundred miles in length—taking 126 min. southbound and 124 min. northbound. The latter booking is at all but 50 m.p.h. from start-to-stop, notwithstanding long grades, as steep in places as 1 in 60, and several severe service slacks. Various other trains over this route have also been materially speeded up. A notable feature of these accelerations is that Belgium has now 780 miles of daily journeys, numbering 24 in all, booked from start to stop at over a mile-a-minute. The new electric services between Brussels and Antwerp consist of three trains to the hour in each direction, two non-stop covering the 27·5 miles in 30 min., at a start-to-stop average of 55 m.p.h., and the third each hour taking 33 min., inclusive of a one-minute stop at Malines.

Railway Share Market

The stock and share markets have been active with advancing prices, business having been stimulated by the Board of Trade returns for May. Home railway stocks maintained their recent strength, although there have not been sensational advances.

The trend of the market is expected to be influenced by the interim statements due to be issued next month. Meanwhile, market interest in the decision of the directors of the London Midland & Scottish regarding the half-year's dividend on the 5 per cent. redeemable preference stock which falls due on Monday has stimulated speculative activity in the company's two other preference stocks. As already explained here, the 4 per cent. first preference stock ranks *pari passu* with the redeemable preference stock, and although the payment of the dividend on the former does not fall due until several weeks after that on the redeemable preference stock, the board's decision indicates whether the dividend on the first preference stock will be forthcoming in August. Hence, the special interest which was taken in both the preference stocks this week. The issue of the company's half-yearly statement, which is expected on July 25, is also arousing much interest because some indication may be given as to prospects of the 1923 preference stock receiving a dividend for the year. The market is not anticipating the payment of an interim dividend which has been foreshadowed in some quarters. The publication of the traffic receipts on Wednesday showing increases on all four lines created a favourable impression and quotations kept firm. London Passenger Transport Board stocks were good, although the " C " stock did not maintain its par value. Metropolitan Assented stock attracted attention from investors and there was a little exchanging out of London Transport " C " stock into the Metropolitan Assented stock.

In foreign railways the chief interest was in Argentine railway debenture stocks where demand arose for stock on an expression of opinion by Viscount St. Davids that as more funds are now being received from Argentina he was confident that very shortly it would be possible to pay part of the interest arrears of the B.A. Pacific and Argentine Great Western second debenture stocks.

Traffic Table of Overseas and Foreign Railways Publishing Weekly Returns

	Railways	Miles open 1934-35	Week Ending	Traffics for Week: Total this year	Traffics for Week: Inc. or Dec. compared with 1934	No. of Weeks	Aggregate Traffics to Date: Totals: This Year	Aggregate Traffics to Date: Totals: Last Year	Aggregate Traffics to Date: Increase or Decrease	Shares or Stock	Prices: Highest 1934	Prices: Lowest 1934	Prices: June 26, 1935	Yield % (See Note)
				£	£		£	£	£					
South & Central America.	Antofagasta (Chili) & Bolivia	830	23.6.35	11,250	— 9,070	25	308,040	323,950	— 15,910	Ord. Stk.	26⅝	19	20½	Nil
	Argentine North Eastern	753	22.6.35	8,288	— 274	51	384,738	419,821	— 35,083	,,	11	6⅞	7	Nil
	Argentine Transandine	111	—	—	—	—	—	—	—	A. Deb.	52	45	32½	12⅝
	Bolivar	174	May, 1935	7,100	+ 500	21	33,400	33,650	— 250	6 p.c. Deb. Bonds.	10	6⅛	10	Nil
	Brazil	—	—	—	—	—	—	—	—		13⅝	10⅞	13	31⅛
	Buenos Ayres & Pacific	2,806	22.6.35	88,412	+ 8,078	51	4,084,905	4,338,864	— 253,959	Ord. Stk.	16½	8½	8	Nil
	Buenos Ayres Central	190	2.6.35	10,048	+ 890	47	461,906	445,487	+ 16,419	Mt. Deb.	23	10	21½	Nil
	Buenos Ayres Gt. Southern	5,085	22.6.35	109,765	— 35,146	51	7,241,787	7,861,419	— 619,632	Ord. Stk.	35	22	23	Nil
	Buenos Ayres Western	1,930	22.6.35	43,529	— 2,589	51	2,327,093	2,661,321	— 334,228	,,	27½	18⅛	18	Nil
	Central Argentine	3,700	22.6.35	122,582	— 15,687	51	6,222,327	6,710,215	— 487,888	,,	23	13½	14	Nil
	Do.	—	—	—	—	—	—	—	—	Dfd.	14	7	7	Nil
	Cent. Uruguay of M. Video	273	22.6.35	9,746	— 5,346	51	679,248	833,584	— 154,336	Ord. Stk.	15½	8	5½	Nil
	Do. Eastern Extn.	311	22.6.35	1,974	— 1,069	51	98,691	173,081	— 74,390	—	—	—	—	—
	Do. Northern Extn.	185	22.6.35	1,261	— 1,180	51	58,414	98,932	— 40,518	—	—	—	—	—
	Do. Western Extn.	211	22.6.35	602	— 257	51	37,729	77,648	— 39,919	—	—	—	—	—
	Cordoba Central	1,218	22.6.35	31,650	— 4,580	51	1,434,560	1,655,200	— 220,640	Ord. Inc.	6	3	2	Nil
	Costa Rica	188	Apl., 1935	13,045	— 1,659	43	162,371	181,164	— 18,793	Stk.	30⅝	23½	32	6¼
	Dorada	70	May, 1935	10,900	+ 600	21	55,000	51,400	+ 3,600	1 Mt. Db.	103	95	102½	5⅞
	Entre Rios	810	22.6.35	11,052	+ 713	51	615,927	608,655	+ 7,272	Ord. Stk.	21½	12	11½	Nil
	Great Western of Brazil	1,082	22.6.35	5,500	— 900	25	207,300	203,400	+ 3,900	Ord. Sh.	⅞	⅝	1/2	Nil
	International of Cl. Amer.	794	Apl., 1935	$455,976	— $12,489	17	$1,763,588	$1,991,549	— $227,961	—	—	—	—	—
	Interoceanic of Mexico	—	—	—	—	—	—	—	—	1st Pref.	1/-	1/-	1/2	Nil
	La Guaira & Caracas	225⅚	May, 1935	4,430	+ 1,255	21	19,930	17,555	+ 2,375	Stk.	12⅝	7⅝	8½	Nil
	Leopoldina	1,918	22.6.35	20,780	— 3,072	25	538,393	529,207	+ 9,186	Ord. Stk.	14⅝	7	4½	Nil
	Mexican	483	21.6.35	$316,300	+ $96,900	24	$5,998,700	$5,566,000	+ $332,700	,,	3⅛	1½	1½	Nil
	Midland of Uruguay	319	May, 1935	6,298	— 2,303	48	104,046	103,709	+ 337	,,	1⅛	½	1½	Nil
	Nitrate	401	15.6.35	8,179	+ 5,629	23	67,104	71,834	— 4,730	Ord. Sh.	32/32	51/	2/4	Nil
	Paraguay Central	274	22.6.35	$1,710,000	+ $256,000	51	$61,611,000	$39,478,000	+ $22,133,000	Pr. Li. Stk.	84	67	75½	7¹⁵⁄₁₆
	Peruvian Corporation	1,059	May, 1935	71,815	+ 9,303	48	697,276	619,408	+ 77,868	Pref.	14½	8	7½	Nil
	Salvador	100	15.6.35	¢12,525	+ ¢4,412	50	¢1,034,332	¢1,035,283	— ¢951	Pr. Li. Db.	75	70	65	7¹¹⁄₁₆
	San Paulo	153½	16.6.35	25,675	— 3,995	23	605,167	668,418	— 63,251	Ord. Stk.	86	67	52	4¹⁵⁄₁₆
	Taltal	164	May, 1935	2,680	+ 1,702	48	34,065	25,050	+ 9,015	Ord. Sh.	2⅛	1⅞	1¼	8
	United of Havana	1,365	22.6.35	22,841	+ 5,749	51	1,134,063	969,253	+ 214,810	Ord. Stk.	6	2	2½	Nil
	Uruguay Northern	73	May. 1935	612	— 436	48	11,338	12,555	— 1,217	Deb. Stk.	6¼	3	4½	Nil
Canada.	Canadian National	23,735	21.6.35	673,358	+ 24,032	24	15,178,318	15,002,852	+ 175,466	—	—	—	—	—
	Canadian Northern	—	—	—	—	—	—	—	— 4 p.c.	Perp. Dbs.	78¼	51½	56½	7¹⁄₁₆
	Grand Trunk	—	—	—	—	—	—	—	—	4 p.c. Gar.	104½	97¼	100½	3¹⁵⁄₁₆
	Canadian Pacific	17,211	21.6.35	474,600	+ 46,000	24	10,667,800	10,741,200	— 73,400	Ord. Stk.	18⅝₁₆	11¹³⁄₁₆	10½	Nil
India.†	Assam Bengal	1,329	31.5.35	33,825	— 9,687	7	195,960	246,645	— 50,685	Ord. Stk.	88½	72	82½	3⅝
	Barsi Light	202	31.5.35	4,110	— 1,762	7	23,370	29,520	— 6,150	Ord. Sh.	104½	98¾	92½	5¹⁵⁄₁₆
	Bengal & North Western	2,114	10.6.35	72,180	— 7,595	8	537,269	579,752	— 42,483	Ord. Stk.	297½	262	293½§	5⅞
	Bengal Dooars & Extension	161	31.5.35	2,911	— 761	7	18,436	20,339	— 1,903	,,	125¼	124	125½	5⁹⁄₁₆
	Bengal-Nagpur	3,268	20.5.35	192,300	+ 3,438	6	916,950	872,685	+ 44,265	,,	105½	96	101½	3¹⁵⁄₁₆
	Bombay, Baroda & Cl. India	3,072	20.6.35	234,150	+ 1,200	9	1,950,675	1,945,575	+ 5,100	,,	115	108½	113½§	5⁵⁄₁₆
	Madras & South'n Mahratta	3,230	31.5.35	175,575	— 33,641	7	962,025	1,105,558	— 143,533	,,	131	122¾	121½	7¹⁵⁄₁₆
	Rohilkund & Kumaon	572	10.6.35	13,850	+ 207	8	110,196	118,400	— 8,204	,,	263	250	290½	5½
	South India	2,526	31.5.35	122,689	— 15,121	7	690,432	725,090	— 34,658	,,	119	115	117½	6¹³⁄₁₆
Various.	Beira-Umtali	204	Apl., 1935	71,379	+ 21,377	30	450,161	340,976	+ 109,185	—	—	—	—	—
	Bilbao River & Cantabrian	15	May, 1935	1,493	+ 143	21	8,644	9,100	— 456	—	—	—	—	—
	Egyptian Delta	622	10.6.35	5,162	— 70	9	36,573	36,439	+ 134	Prf. Sh.	21⅝₁₆	15¼	21⅜	4
	Great Southern of Spain	104	15.5.35	1,724	+ 154	24	45,188	52,334	— 7,146	Inc. Deb.	4	3½	3½	Nil
	Kenya & Uganda	1,625	31.5.35	202,402	+ 11,533	21	1,127,245	1,050,349	+ 76,896	—	—	—	—	—
	Manila	—	—	—	—	—	—	—	—	B. Deb.	50	33	44½	7⅞
	Mashonaland	913	Apr., 1935	132,251	+ 38,693	30	820,037	624,162	+ 195,875	1 Mg. Db.	101	91¼	102½	4⅞
	Midland of W. Australia	277	Apl., 1935	12,561	+ 735	43	134,787	134,040	+ 747	Inc. Deb.	100	93	94½	5⁹⁄₁₆
	Nigerian	1,905	11.5.35	32,010	— 66	6	173,989	163,178	+ 10,811	—	—	—	—	—
	Rhodesia	1,538	Apr., 1935	205,519	+ 50,699	30	1,342,580	1,063,276	+ 279,304	4 p.c. Db.	104⅞	97½	104	3¹⁵⁄₁₆
	South African	13,217	1.6.35	526,564	+ 62,965	9	4,785,523	4,244,781	+ 540,742	—	—	—	—	—
	Victorian	6,172	Jan., 1935	834,638	— 17,346	30	5,586,612	5,388,619	+ 197,993	—	—	—	—	—
	Zafra & Huelva	112	May, 1935	10,848	— 233	21	55,398	55,722	— 324	—	—	—	—	—

NOTE.—Yields are based on the approximate current prices and are within a fraction of 1/16

† Receipts are calculated @ 1s. 6d. to the rupee. § ex dividend. Salvador and Paraguay Central receipts are in currency

The variation in Sterling value of the Argentine paper peso has lately been so great that the method of converting the sterling weekly receipts at the par rate of exchang has proved misleading, the amount being overestimated. The statements from July 1 onwards are based on the current rate of exchange and not on the par value

The Eastbourne and Hastings Electrification, Southern Railway

WHEN the Brighton electrification was completed and electric services began to run from London to that town and to West Worthing on January 1, 1933, it was generally realised that this conversion of nearly 160 track miles of main line would be by no means the last important line to be converted by the Southern Railway. Little surprise was felt, therefore, when in December, 1933, the Directors decided to proceed with the conversion of another 60 miles of route, embracing the lines to Lewes, Seaford, Eastbourne and Hastings from Haywards Heatn and Brighton. In the relatively short space of 18 months, this scheme has been completed, and in addition to the remarkable facilities to travellers which electrification has permitted, the conversion has enabled the electric rolling stock to be used more efficiently. The increased traffic facilities have extended beyond the recently electrified zone to Brighton and Worthing each of which towns has an extra service to and from London in the business hours. We have followed closely the various stages in the electrification work and the inauguration of the public service, and while it may appear invidious to single out any one feature as being above the general high standard of merit, we cannot forbear expressing appreciation of the skilful way in which the timetables have been worked out in the face of numerous difficulties, as indicated in the Traffic Operation section of this supplement. The public service has been increased by over 60 per cent., judged on the basis of train miles, but the connections between certain towns show an increase of over 100 per cent. in frequency. Almost needless to emphasise, this £1,750,000 conversion scheme has been of considerable benefit to British industry, and, taken as a vote of confidence in the performance and possibilities of electric traction, it may have such influence that the electrical and allied trades may reap further benefit from other sources.

The primary responsibility for this comprehensive electrification must be credited to Sir Herbert Walker, the General Manager, who has always been quick to take advantage of the operating characteristics of multiple-unit electric traction. The conversion scheme was prepared and carried out by Mr. Alfred Raworth, the company's Electrical Engineer for New Works, and that gentleman has been responsible also for the design, layout and installation of the whole of the electrical equipment. The rolling stock, apart from the electrical equipment, which came under Mr. Raworth's jurisdiction, has been designed by Mr. R. E. L. Maunsell, the Chief Mechanical Engineer. All the civil engineering works, including the laying of the conductor rails and the erection of the substation and control room buildings, have been undertaken by Mr. George Ellson, the Chief Engineer, while the traffic arrangements have been prepared by Mr. E. C. Cox, the Traffic Manager. To all of these gentlemen and to Mr. C. Grasemann, the Public Relations and Advertising Officer, we tender, not only our appreciation of the works by which we know them, but also our thanks for the facilities granted us for inspecting the equipment, facilities which have made the compilation of this Supplement a pleasant duty.

Reproduction of one of the Southern Railway's coloured posters announcing the opening of the Hastings and Eastbourne lines

AN EPITOME OF SOUTHERN ELECTRIFICATION—1932–35

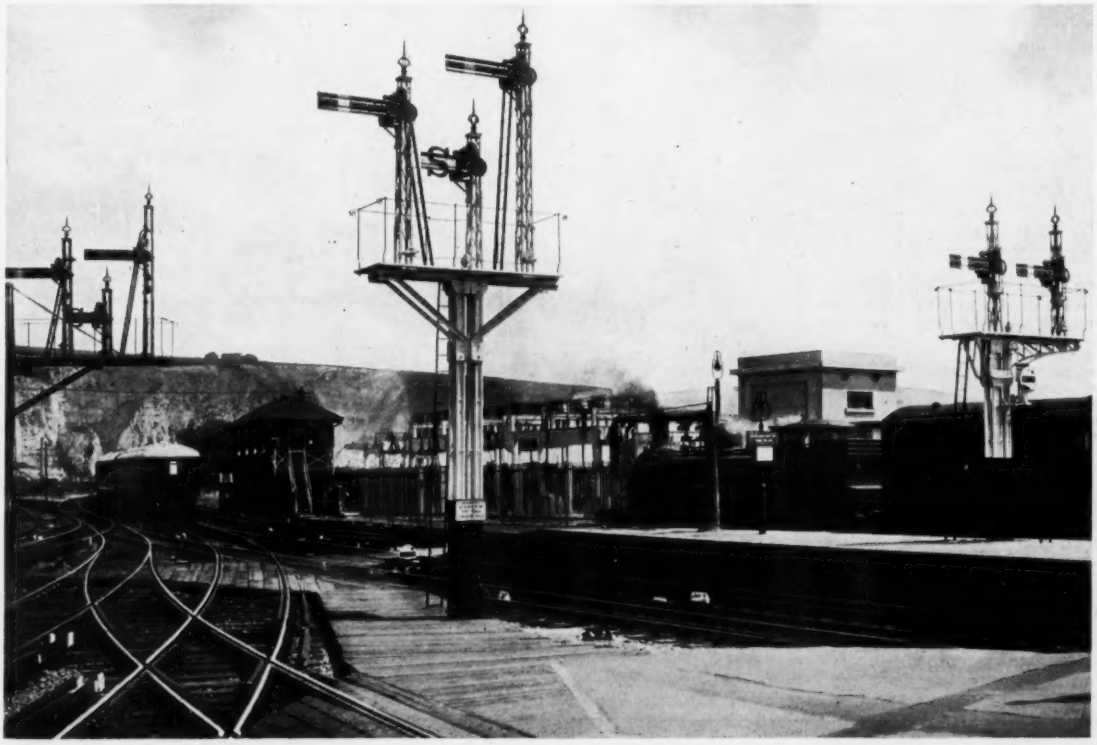
A Résumé of Southern Electrification History

ELECTRIFICATION history of the Southern Railway and its constituent companies dates from 1903, when, having obtained Parliamentary powers, the London, Brighton & South Coast Railway instructed its consulting electrical engineer to prepare a report on the question of the conversion of the suburban lines. As a result of this report, contracts were let for the electrification of the South London line, and this $8\frac{3}{4}$ mile length between Victoria and London Bridge via Denmark Hill was completed in 1909.

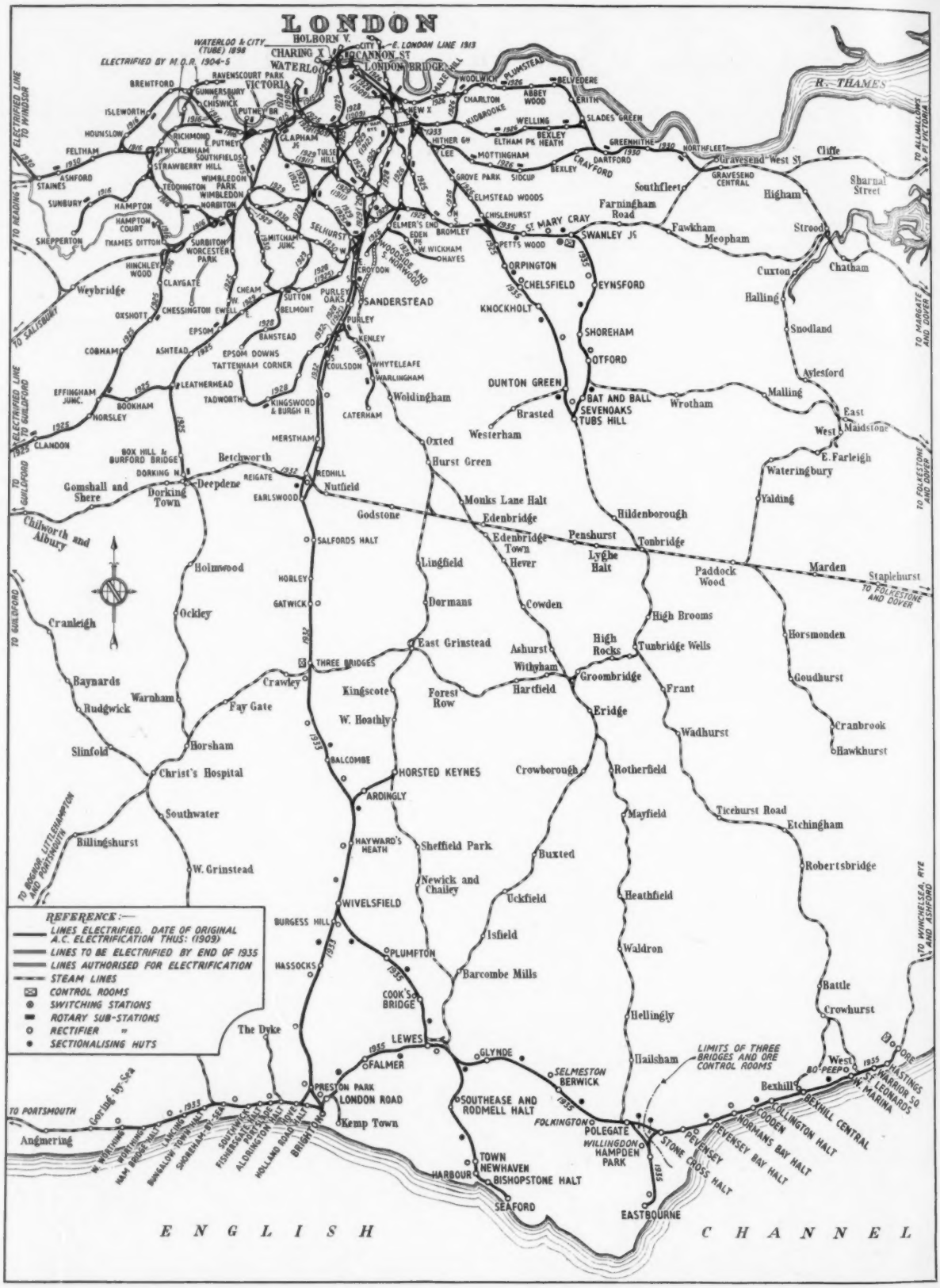
This L.B.S.C.R. conversion was on the 6,600-volt single-phase system, partly because of the high development of that principle in the first years of this century, and partly because even at that early date main line extensions to Brighton and the coast were envisaged. Extensions to the Crystal Palace from both Victoria and London Bridge were completed before the war, and others to Coulsdon, Sutton, Eastbourne and Brighton were authorised. But due to the war only the Coulsdon and Sutton lines were converted to single-phase traction, and these not until 1925.

In 1915, the London & South Western Railway began electric operation over the Kingston roundabout, and the Waterloo to Wimbledon line via Putney. The progress made just before the war in the design and operation of low voltage direct current traction decided the Directors to adopt this system. Extensions were made in 1916 to Shepperton, Hampton Court, and Claygate; and after the amalgamation of 1923 direct current was adopted as the standard for future conversions. The year 1925 saw the conversion of the lines to Guildford and Dorking, and 1930 that of the Windsor line. The year 1926 was memorable for the opening of the first section of the South Eastern & Chatham electrification, under the auspices of the Southern Railway. Originally this electrification had been planned just after the war to use 1,500 volts d.c. and to embrace the conversion of the suburban lines in the first place and then the lines to Gillingham, Tonbridge and Redhill. In the course of time the whole railway would have been electrified. From 1926 onwards, extensions of the third rail low voltage d.c. system on the suburban lines has been progressive and culminated in the opening to electric traction of the two routes to Sevenoaks in February last. The Sanderstead line and Nunhead-Lewisham loop are due to be opened to electric traction in October of this year. The old L.B.S.C.R. single-phase lines were changed to low voltage d.c. in 1929, but some of the old masts still exist as signal gantries.

A notable decision was made in 1930, when electrification to Brighton and West Worthing was begun, and turned the Southern definitely into a believer in the electrification of densely-trafficked main as well as suburban lines. The first stage, to Redhill, Reigate, and Three Bridges was opened on July 17, 1932, and the southern half of the line on January 1, 1933; both these stages were described in detail in special Supplements to THE RAILWAY GAZETTE for July 22, 1932, and December 31, 1932. Work on the 60-mile extension to Lewes, Eastbourne, and Hastings was begun at the end of 1933, and the public electric service will be inaugurated on July 7, 1935, when a total of 444 route and 1,156 track miles will be operated electrically by the Southern Railway.



View from the east end of Lewes station showing the substation and a six-car vestibuled trial train



Map of Southern Railway electrified system showing the newly-converted Eastbourne and Hastings lines

Traffic Operation

JUDGED by the standards of the London-Brighton section, the Keymer Junction-Lewes-Eastbourne-Hastings lines are not heavily trafficked, but as there are no four-line sections the greatly increased services now in operation provide fully-occupied tracks, especially during the business hours, when extra trains are run to and from both Brighton and London. The key points are Lewes, where all the electric trains pass through the junction at the east end of the station, and Willingdon Junction, where a maximum of 12 electric trains an hour on one track work through the junction and over single up and down lines to and from Eastbourne. At each of these junctions certain steam workings are sandwiched in between the electric services. Over the 60 miles of route electrified, approximately 2,900,000 electric train-miles a year have replaced 1,730,000 steam train-miles.

Hourly Fast Service

The comprehensive electric train service comprises an hourly fast service with Pullman and buffet car accommodation to and from London; stopping services along the coast from Brighton to Seaford and from Brighton to Eastbourne, Hastings and Ore; and a stopping service between Seaford and Horsted Keynes via Haywards Heath. Three new types of trains are being used, viz., a six-car vestibuled set with a buffet, for the direct services, (17 sets); a two-car corridor non-vestibuled set, mainly for semi-fasts, and which can be made up into two, four, six or eight-car units as required, (10 sets); and two-car non-corridor sets for stopping trains (32 sets). The express trains from London are composed normally of a new six-coach buffet car set and a standard six-car Brighton Pullman set. This 12-car train runs to Eastbourne, and the Pullman set only thence to Hastings and Ore; the new six-car set is picked up at Eastbourne on the return trip. Certain relief trains running no farther than Eastbourne are composed of buffet car sets only, and on weekdays there are morning and evening through buffet-car services from and to Seaford. Some of these buffet-car sets are also in operation on the London-Brighton section to balance the handing over of the Pullman sets to the Hastings service. By this interchange of stock the 8.35 a.m. up and 4.0 p.m. down between Victoria and Brighton are now composed of vestibuled trains with Pullman accommodation; previously the 4.0 p.m. was the only one-hour train between London and Brighton which was made up of semi-fast stock.

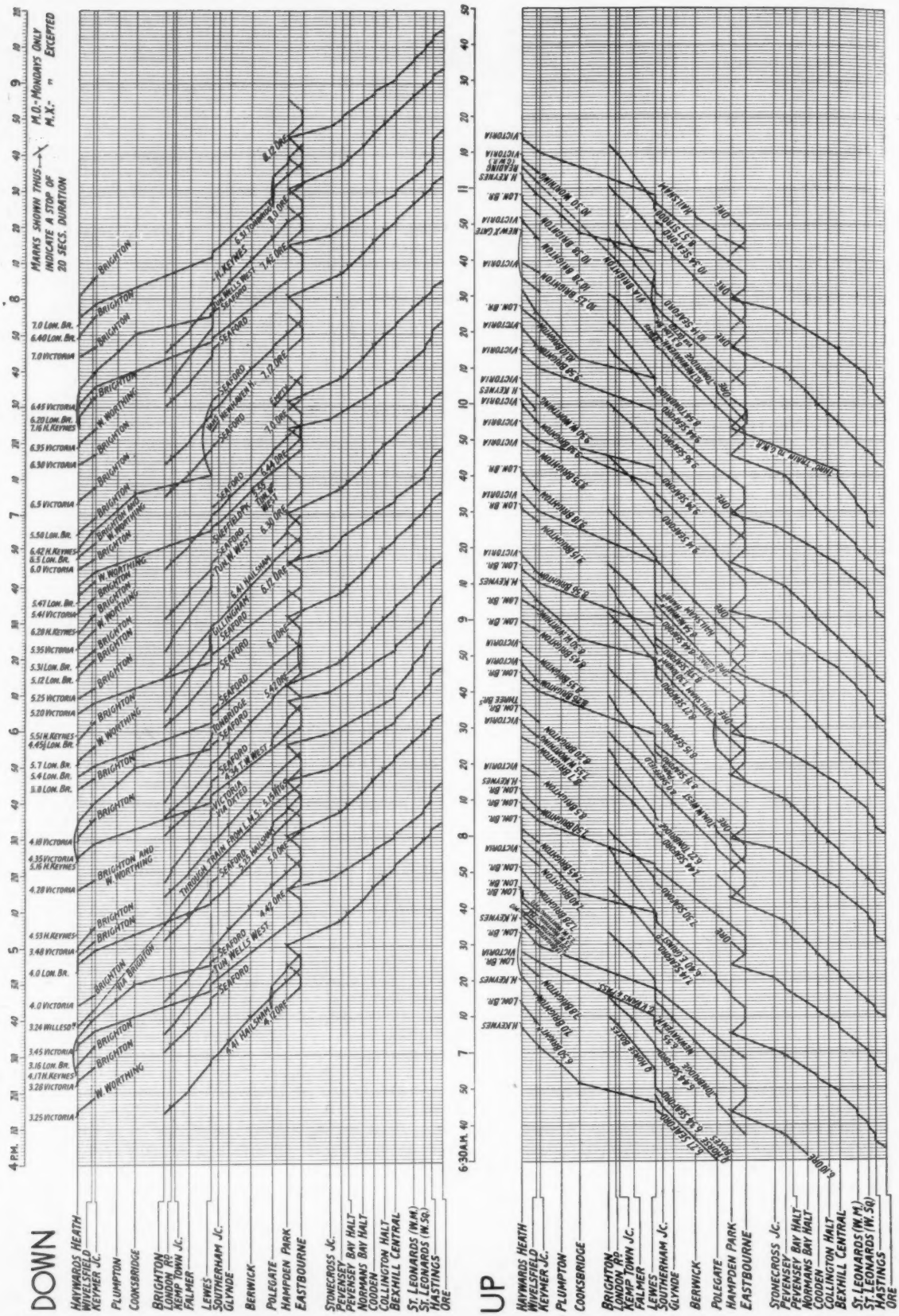
All the direct trains, except one or two at business hours, stop at East Croydon, Haywards Heath, and Lewes, and the six-car set running on from Eastbourne stops at Cooden Beach, Bexhill (Central), St. Leonards (Warrior Square), Hastings and Ore. Throughout the day there is a regular hourly service of vestibuled trains starting from Victoria at 45 min. past the hour and maintaining the same intermediate times over the whole journey, an excellent feature following the practice of the Brighton line. In the reverse direction the London trains leave Ore at the hour and Hastings at five minutes past. The standard times are 63 min. to Lewes (50 miles); 84 min. to Eastbourne (65¾ miles); and 115 min. to Hastings (82¾ miles). In the reverse direction the timing is two min. extra from Hastings and Eastbourne and one min. extra from Lewes. These schedules are even better than they look, for over the lift bridge spanning the Ouse near Lewes there is a slack to 20 m.p.h., one each through Lewes tunnel and Keymer Junction of 15 m.p.h., and one at Polegate to 20 m.p.h. The effect of the Lewes slack is seen in the slightly increased times allowed to up trains.

Stations between Haywards Heath and Lewes are served by an hourly two-car service running from Horsted Keynes to Seaford, and these trains follow the London-Eastbourne hourly fast trains from Haywards Heath with a gap of only 2 min., arriving at Lewes 7 min. after the fast. At Lewes, passengers for the intermediate stations on the Eastbourne and Hastings line are picked up by a stopping train from Brighton after a wait of only 4 min. Passengers from Brighton to Eastbourne or Hastings can travel by the previous train and go on from Lewes by the fast from London after a wait of 5 min. Alternate stopping trains from Brighton go to Seaford and Eastbourne-Hastings with stops at all stations. The longest wait at Lewes is 25 min. for a passenger wishing to go from one of the intermediate stations on the Lewes-Eastbourne-Hastings line to one of the two intermediate stations (Cooksbridge and Plumpton) on the Lewes-Haywards Heath section. Apart from this, no wait at Lewes exceeds 12 min. Features of the operation in this district are the 15-min. service between Brighton and Lewes, and the 10-min. service from Lewes to the seaside (Brighton, Seaford, Eastbourne, and Hastings).

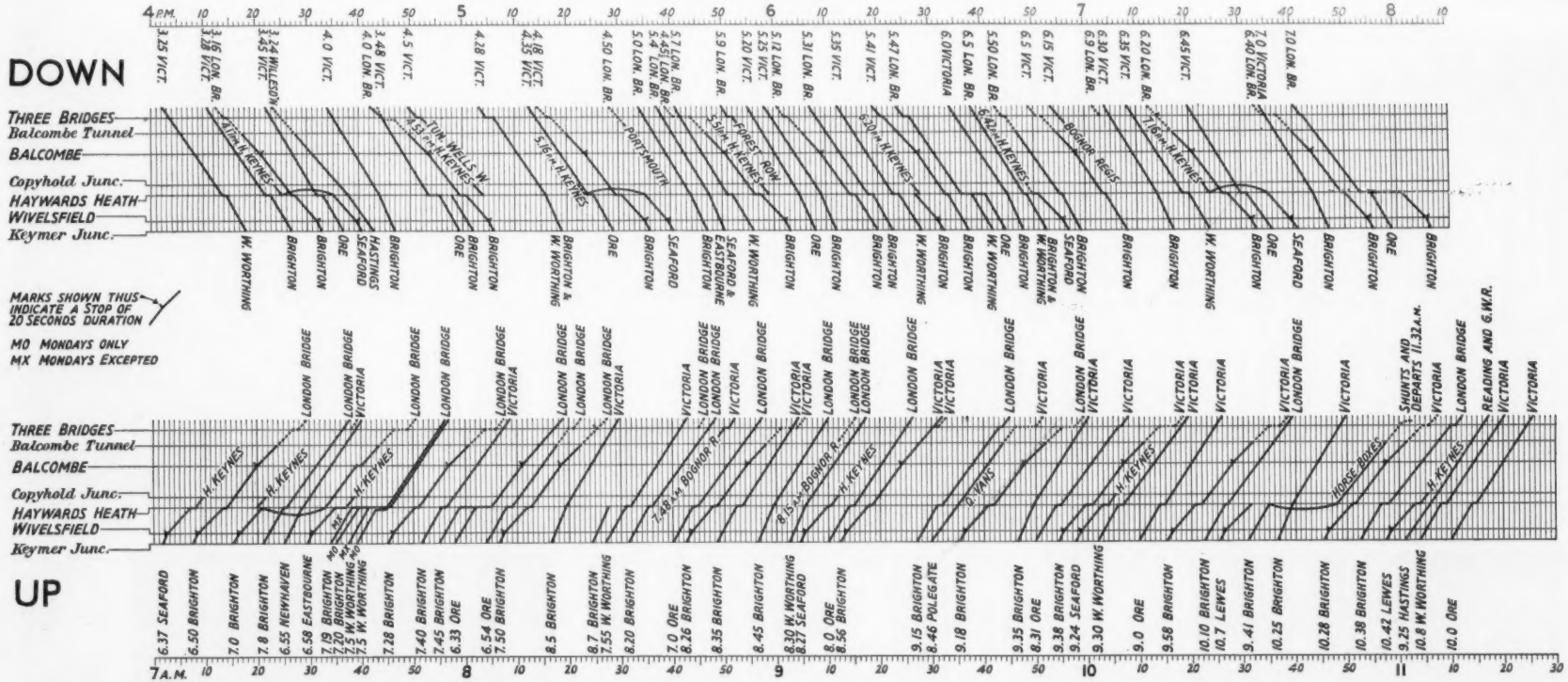
Later and Better Service to Coast Towns

Electrification has resulted in the theatre-goer from the coast reaping a decided benefit, for the present train service permits him to leave Victoria at midnight, arrive at Lewes at 1.4 a.m., Eastbourne at 1.28 a.m., and Hastings (after a change at Polegate) at 1.51 a.m. With the steam service the last train left Victoria at 11.40 p.m. and reached Eastbourne at 1.25 a.m. (after a change at Haywards Heath); Hastings could be reached only by a double change. The traveller by the last down train should also feel the boon of the refreshment service provided. The conversion of the Eastbourne lines has resulted in improved facilities between Worthing, Brighton, and London at the business hours. An additional service from Worthing has long been sought, but no path through the London suburban area could be found which would bring the train into the Metropolis at about 9.0 a.m. Now, however, a four-car train leaves Worthing at 7.22 a.m., runs into Brighton, leaves at 7.45 and runs on to Haywards Heath, where it is joined to the electric train leaving Eastbourne at 7.12 a.m. (which replaces a previous steam train); the combined set then runs on to London Bridge, which is reached at 8.56 a.m. Similar improvements in the down direction between 5.30 and 6.5 p.m. result in Worthing, Hove, and Shoreham getting an extra through service.

The Sunday timetables include an hourly fast service from London to Eastbourne and Hastings in the morning, and after 12.45 p.m. a two-hourly service until after six o'clock, when an hourly service is re-instituted until 10.45 p.m. There are also the usual 15-min. alternate services from Brighton along the coast to Ore and Seaford. The times from Brighton to Eastbourne and Brighton to Hastings are the usual weekday standards of 40 min. and 77 min. respectively. On Saturdays during the summer, an extra hourly service from Victoria to Eastbourne and Hastings has been instituted, leaving Victoria at 15 min. past the hour from 9.15 a.m. to 3.15 p.m. In conjunction with the regular trains at 45 min. past the hour, this gives a half-hourly service to these two popular



Graphic timetable showing density of traffic (Saturdays excepted) on the Haywards Heath, Eastbourne and Hastings Lines



Graphic timetable showing traffic density (Saturdays excepted) between Three Bridges and Haywards Heath

COMPARATIVE SUMMER TRAIN SERVICES

Between	Steam		Electric			
	No. of Services, Week-days.	Average Time on Journey.	No. of Services, Week-days.	Average Time on Journey.	Increase Per cent.	Average Accel.
		h. m.		h. m.		
London and Lewes	NS 19 SO 24	1 15	NS 24 SO 30	1 6	26 25	9
Lewes and London	NS 17 SO 22	1 17	NS 22 SO 29	1 8	29 32	9
London and Seaford	NS 16 SO 22	1 43	NS 22 SO 26	1 28	37 18	15
Seaford and London	NS 17 SO 18	1 49	NS 22 SO 22	1 31	29 22	18
London and Eastbourne	NS 17 SO 25	1 41	NS 22 SO 30	1 27	29 20	14
Eastbourne and London	NS 17 SO 23	1 42	NS 21 SO 27	1 31	24 17	11
London and Bexhill Central	NS 14 SO 14	1 59	NS 21 SO 25	1 47	50 79	12
Bexhill Central and London	NS 14 SO 14	2 0	NS 21 SO 24	1 51	50 71	9
London and Hastings (via Lewes)	NS 14 SO 14	2 15	NS 21 SO 25	1 59	50 79	16
Hastings and London (via Lewes)	NS 13 SO 13	2 17	NS 21 SO 24	2 2	62 85	15
Brighton and Seaford	NS 27 SO 30	0 47	NS 44 SO 44	0 34	63 47	13
Seaford and Brighton	NS 25 SO 25	0 43	NS 42 SO 40	0 34	68 60	9
Brighton and Eastbourne	NS 30 SO 34	0 55	NS 51 SO 55	0 39	70 62	16
Eastbourne and Brighton	NS 31 SO 32	0 52	NS 50 SO 54	0 41	61 69	11
Brighton and Bexhill Central	NS 23 SO 24	1 9	NS 49 SO 53	1 5	113 121	4
Bexhill Central and Brighton	NS 22 SO 22	1 3	NS 50 SO 54	1 6	127 145	—
Brighton and Hastings	NS 23 SO 24	1 27	NS 49 SO 53	1 15	113 121	12
Hastings and Brighton	NS 22 SO 22	1 21	NS 50 SO 54	1 15	127 145	6

seaside resorts. Corresponding up trains are also run on Saturday.

A certain number of steam trains are dovetailed into the schedules, more particularly over the Brighton-Lewes line, and the incidence of these in the down direction during the morning and evening is shown in the accompanying graphic timetables. The through steam-hauled trains between Brighton and Ashford have disappeared from the timetables, and in their place a shuttle service between Ashford and Hastings has been introduced to connect with the numerous electric trains. Thus, although there is now no through service, passengers from Kent to Brighton have better facilities than formerly. Actually, the increase in the train service between Hastings and Brighton during weekdays in summer is no less than 127 per cent., and 145 per cent. on Saturdays. No place on the new electrified system has less than 24 per cent. increase in service from the main towns in the area. The Victoria-Newhaven boat trains continue to be worked by steam locomotives. The increased service from London to Eastbourne and Hastings has produced an even greater traffic density between London and Keymer junction, but with symmetrical timetables, and the exact timing which is permitted by electrification, punctual operation is ensured.

The route indicating numbers form an extension of the system introduced in 1932 when the Three Bridges line was electrified. These numbers not only indicate the destination of each train but also its classification, so that a signalman can identify any train at a glance. For convenience in reference, the code list of the whole of the Southern main line and south coast local services is given herewith.

Signalling

Taking the new electrification as a whole, the signalling has not been altered to any great extent. Modifications have been made to the signalling at Lewes to permit of the free movement of the large number of trains through the junction at the east end of the station. Extensive track circuiting has been installed at Eastbourne station, where the platforms have been lengthened so that all of them can now take a 12-car train. This alteration was essential in view of the traffic density between Eastbourne and Willingdon Junction. On this section an intermediate home signal has been provided on both up and down lines, because the section from Hampden Park down advanced starting signal to Eastbourne is over $1\frac{1}{2}$ miles long, *i.e.*, a three-minute run for electric trains and four minutes for steam. The present timetables include sequences of three trains in seven minutes, and four trains in eleven minutes, and it was necessary therefore to provide an intermediate home signal in order to give the requisite headway. Similar remarks apply to the up line, where the section from Eastbourne to Hampden Park is nearly 2 miles long.

Illustration showing method of attaching negative feeder cables to impedance bonds in a double rail track circuited section, and also the attachment of the 660-volt cables to the third rails and the track feeders from a substation

Route Indications for Electric Trains

Service	Route	Class of Train	Route Indications.
Victoria and Brighton	Quarry	Fast Passenger	4
		Semi-fast Passenger	6
		Slow Passenger	8
		Special Passenger	20
Victoria and Brighton	Redhill	Fast Passenger	10
		Semi-fast Passenger	12
		Slow Passenger	14
		Special Passenger	24
Victoria and West Worthing	Quarry	Passenger	16
		Special Passenger	26
Victoria and West Worthing	Redhill	Passenger	18
		Special Passenger	28
Victoria and Reigate	Redhill	All	34
Victoria, Gatwick, Plumpton or Lewes	Quarry	Race Special	30
	Redhill	Race Special	32
Charing Cross and Reigate	.. ..	All	41
Redhill and Reigate	.. ..	..	2
London Bridge and Brighton	Quarry	Fast Passenger	3
		Semi-fast Passenger	5
		Slow Passenger	7
		Special Passenger	21
London Bridge and Brighton	Redhill	Fast Passenger	9
		Semi-fast Passenger	13
		Slow Passenger	15
		Special Passenger	23
London Bridge and West Worthing	Quarry	Passenger	17
		Special Passenger	27
London Bridge and West Worthing	Redhill	Passenger	19
		Special Passenger	29
London Bridge and Reigate	Redhill	All	37
London Bridge, Gatwick, Plumpton or Lewes	Quarry	Race Special	31
	Redhill	Race Special	35
Haywards Heath and Brighton	.. ..	All	2
Preston Park and Brighton	.. ..	All	1
Brighton and West Worthing	.. ..	Passenger	1
Brighton and West Worthing	Preston Park	Passenger	32
S. Bermondsey and Brighton	Quarry	Special Passenger	38
Streatham Hill and Brighton	Quarry	Special Passenger	39
Victoria and Ore	Quarry and Eastbourne	Passenger	50
		Special Passenger	52
Victoria and Ore	Direct Quarry (*not via Eastbourne*).	Passenger	54
Victoria and Ore	Redhill and Eastbourne	Passenger	56
		Special Passenger	58
Victoria and Ore	Direct Redhill (*not via Eastbourne*)	Passenger	60
Victoria and Eastbourne	Quarry	Passenger	62
Victoria and Eastbourne	Redhill	Passenger	64
Victoria and Seaford	Quarry	Passenger	68
Victoria and Seaford	Redhill	Passenger	70
London Bridge and Ore	Quarry and Eastbourne	Passenger	51
		Special Passenger	53
London Bridge and Ore	Direct Quarry (*not via Eastbourne*).	Passenger	57
London Bridge and Ore	Redhill and Eastbourne	Passenger	59
		Special Passenger	61
London Bridge and Ore	Direct Redhill (*not via Eastbourne*).	Passenger	63
London Bridge and Eastbourne	Quarry	Passenger	65
London Bridge and Eastbourne	Redhill	Passenger	67
London Bridge and Seaford	Quarry	Passenger	69
London Bridge and Seaford	Redhill	Passenger	71
Haywards Heath and Ore	Direct	Passenger	47
Horsted Keynes or Haywards Heath and Eastbourne	.. ..	Passenger	49
Brighton and Hastings or Ore	Eastbourne	Passenger	16
Brighton and Hastings or Ore	Direct	Passenger	26
Brighton and Eastbourne	.. ..	Passenger	18
Brighton and Seaford	.. ..	Passenger	28
Brighton and Lewes	.. ..	Passenger	17
Brighton, Gatwick, Plumpton or Lewes	.. ..	Race Special	45
Eastbourne and Ore	.. ..	Passenger	1
Lewes and Seaford	.. ..	Passenger	1
Horsted Keynes or Haywards Heath and Seaford	.. ..	Passenger	37
Horsted Keynes or Haywards Heath and Lewes	.. ..	Passenger	46
Horsted Keynes and Haywards Heath	.. ..	Passenger	1
Eastbourne and Polegate	.. ..	Passenger	2

Civil Engineering Works

FOR the extension of electrification to Seaford, Eastbourne and Hastings the principal works undertaken by Mr. George Ellson, the Chief Engineer of the Southern, were at Lewes, where the platforms were extended, permanent way altered, and the tunnel widened. This last now also makes it possible to work the longest and widest Southern stock over the line. At Eastbourne, the platforms have been lengthened to 820 ft. so as to take 12-car trains and a simplified permanent way layout installed; at Cooden Beach a new station with platforms 420 ft. long is being built to replace the halt; and at Ore a new carriage shed similar to that at West Worthing has been provided.

The works at Lewes were described in THE RAILWAY GAZETTE for March 1. The down main and loop platforms have been extended from 500 to 760 ft. in length and the up main platform from 580 to 793 ft. Besides the tunnel widening, a brick arch overbridge has been replaced by a steel and concrete structure of longer span to accommodate the widened lines and extended platforms. The widening of the tunnel has made possible the easing of the curve in the main line from six to eight chains minimum radius. The method adopted for widening the tunnel was to build a new wall behind the old one on the down side, the old arch afterwards being taken out in 5 ft. sections and the new arch constructed, joining up a few feet beyond the crown towards the up side.

Other alterations at Lewes were the extension of the platform roofing and the installation of lifts to deal with luggage via the existing footbridge. Also, the signal box on the up side has been replaced by a new box on the down side, and two crossovers between the platforms have been taken out and replaced by a new crossover on the Tunbridge Wells line just east of the station.

A little south of Lewes station the railway crosses the River Ouse by a bridge, the central span of which has to be raised to permit the passage of vessels. The 33 kV. feeder cables which supply the current for electric traction could not be laid over the bridge and were therefore placed beneath the river bed in pipes encased in concrete. To enable the trench to be dug to a depth of about 3 ft. below the bed of the river the latter had to be dammed in sections and the water pumped out. The cables were threaded through the cast-iron pipes, which were greased to enable them to run through smoothly. The signalling cables are also carried through the concrete tunnel in cast-iron pipes.

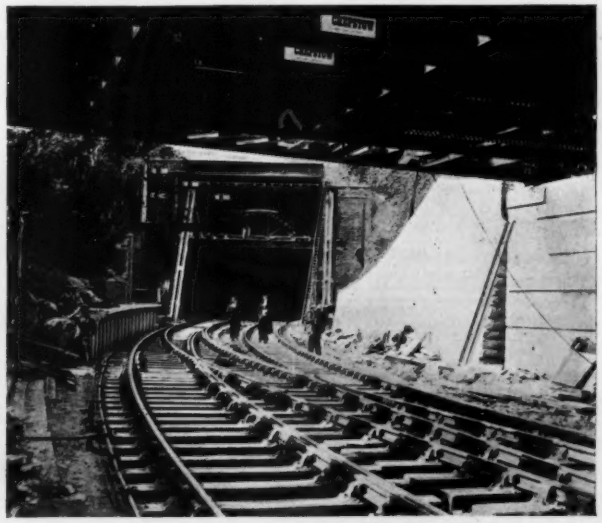
Pulling the 33 kV. feeder cables through the concrete tunnel laid beneath the river Ouse, near Lewes

The carriage shed at Ore is of the company's latest standard design and is of steel framing covered with Big Six corrugated asbestos sheeting. It is 60 ft. wide and contains four roads each 820 ft. long. The equipment includes hot and cold water supplies, a vacuum cleaning plant for the car interiors, and a complete system of drainage on the concrete floor. This scheme has entailed the construction of a retaining wall along the Parker Road frontage and the re-arrangement of the coal depot and yard.

Mr. Ellson's responsibilities also included, besides the signalling works already referred to on page 1284, the preparation of the ground and the erection of the buildings for the 16 substations and 14 track-paralleling huts on the system, for the building housing the control room at Ore for the conductor rails, and the preparation of route and laying of the h.t. and feeder cables. At certain points cleaning stages and water supplies have been laid down to facilitate the cleaning of the stock.

Right: View from the west end of Lewes station showing the extensions to the up main platform and the tunnel widening works in course of construction

Below: Alterations to track and signalling and platform extension works in progress at Eastbourne



Power Supply and Distribution

THE energy supply for the Eastbourne and Hastings lines is obtained from the Central Electricity Board grid, as in all recent extensions. The current is supplied partly from the feeding points already established at Three Bridges and Brighton for the Brighton and West Worthing extension, and partly from two additional points, *viz.* the grid substations at Eastbourne and Hastings. The supply is taken from the grid at 33 kV. three-phase 50-cycles, and an e.h.t. cable has been laid by the Southern Railway between Eastbourne and Hastings, and between Eastbourne and Keymer Junction where connection is made with the railway feeder cable between Three Bridges and Brighton grid substations. By this means what is virtually a ring main has been established, as shown in one of the accompanying diagrams.

The high tension and pilot cable runs are similar in construction to those on the Brighton extension. The cables are laid in wooden troughs supported on concrete posts, but concrete troughing is used where it is necessary to bury the cables. The 33 kV. cable consists of three single-core paper insulated lead covered cables, made up into a three-core cable, jute served, and single-wire armoured. In tunnels and other confined places, where it would be difficult to find space for the three-core joint, three single-core cables are used and these are armoured with non-magnetic wire. The three-core cable joints are of the Pirelli patent type, as shown in the attached illustration. Each core joint is enclosed in a separate lead sleeve, compound filled. The three joints are enclosed in a concrete box with cast iron end plates and supported on earthenware spacers. The outer concrete box is also filled with compound. The lead sheaths of the three cores are bonded together and to the cast iron end plates, which carry the armour clamps. The armouring wires of each cable are carried through the armour clamp into the outer concrete box, where they are bonded together. The complete joint weighing about one ton, is supported in the line of the cable by means of steel stools, grouted into concrete foundations. The four-core cable for the feeder protection is an impregnated paper-insulated and lead-covered double steel-tape armoured 660-volt cable.

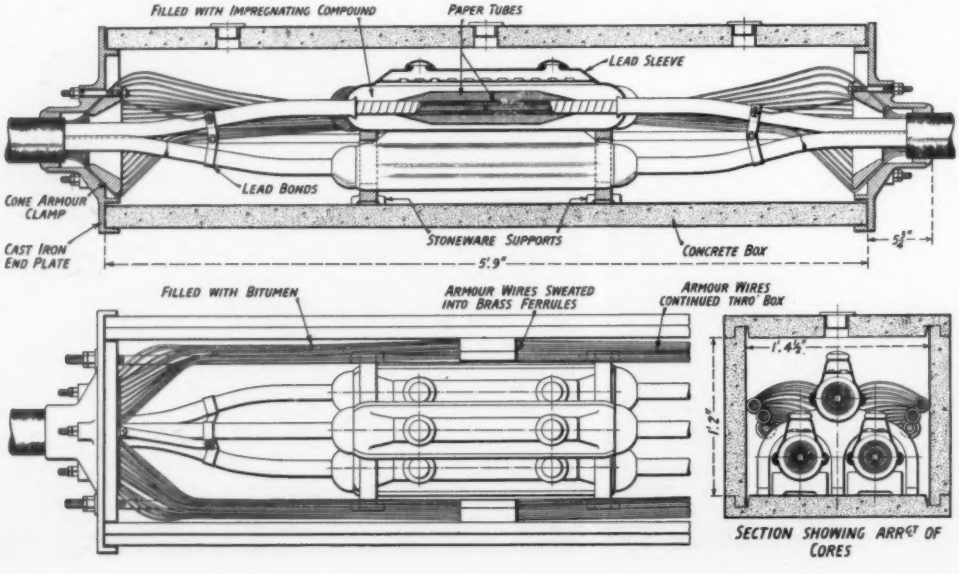
An improved type of differential feeder protection has been provided between substations, and between the grid substations and those of the railway company. The relays are instantaneous in action and the system operates with such low currents as 45 amp. for earth faults and 160 amp. for short circuits between phases.

Substations

Following recent practice on the Southern, the 33 kV. cable is looped in and out of the railway substations *en route*. The current at this tension is distributed to each remotely-controlled substation, where it is converted to 660 volts d.c. for distribution to the track. Sixteen substations and 14 track paralleling huts have been built to serve the new area, and their general design is similar to that adopted on the Brighton and the Sevenoaks lines. Each substation consists of two sections; one comprising the e.h.t. switchgear and the other the rectifier and the switchgear for controlling the distribution of d.c. to the trains. All the substations are identical as regards equipment, and practically so in the matter of layout, except at Lewes, Newhaven, and Falmer, where local conditions have necessitated some rearrangement.

The e.h.t. switchgear and isolators are supported on reinforced concrete frameworks, at each end of which the e.h.t. feeder cable looping into the substations is terminated. Each incoming feeder is taken through an isolator to an oil switch with a rupturing capacity of 500,000 kVA. Connection is made from each of these feeder oil switches through duplicate isolators on to the opposite ends of a busbar, thus providing the connection for completing the loop. By means of a tee-off connection on this busbar the energy is supplied to an outdoor oil-cooled main transformer through an oil switch and its accompanying isolator. This transformer steps down the 33-kV. three-phase supply to a double six-phase supply at the voltage required by the anodes of the rectifier. Adjacent to the main transformer are two small units forming the absorption choke coils.

Between these choke coils is installed a small excitation



Sectional arrangement of Pirelli patent joint as used for the 33 kV. feeder cables supplying the substations on the Eastbourne and Hastings electrified lines of the Southern Railway

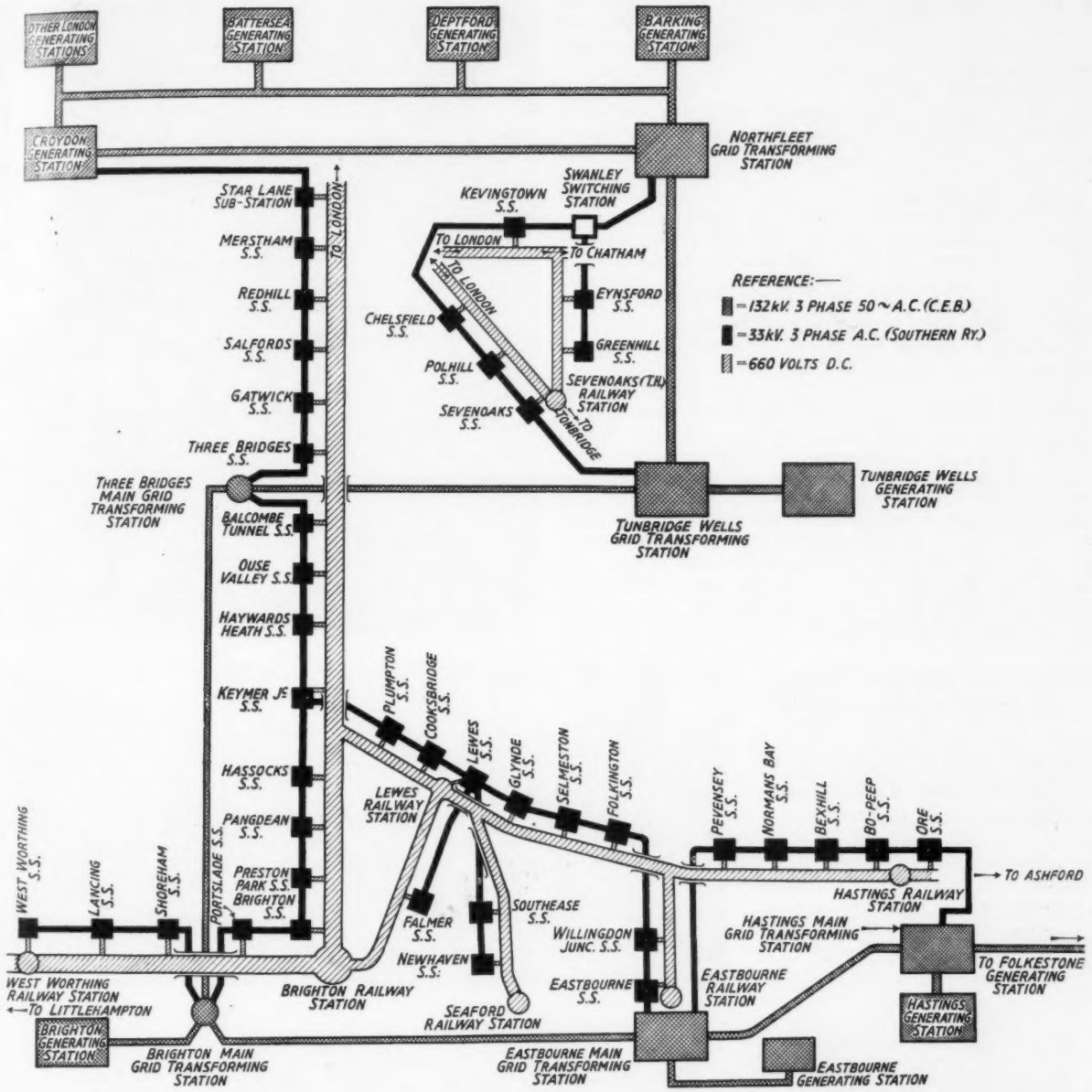


Diagram showing the supply and distribution of power on the Brighton, Sevenoaks, Eastbourne and Hastings lines

unit, the purpose of which is to limit the no-load voltage of the rectifier.

Direct connection is made through switch fuses from each of the two incoming feeders to a 20-kVA. single-phase transformer, from which energy is supplied for signalling, lighting, and other substation auxiliary purposes. Three-phase energy at 440 volts is obtained for the rectifier auxiliaries from a 30-kVA. transformer which is connected through a switch fuse to the busbar from which the main tee-off connection is taken.

All the e.h.t. oil switches on the system are of the same capacity and are interchangeable. They are designed for a working load of 44 kV. 350 amp. and a rupturing capacity of 500,000 kVA. They are motor operated and the closing effort is provided by two spiral springs which are compressed by the motor. They can be operated from three positions: (1) at the operating cubicle of the switch, by hand; (2) at the substation switchboard, by remote control, and (3) from the central control room, by supervisory control. The hand control is normally locked, to prevent any inadvertent operation. Selection of the other two methods is provided by means of a change-over switch on the substation control panel. All the insulators on the outdoor e.h.t. gear are designed for a working voltage of 44 kV.

Due to the convergence of four feeder cables at Lewes, the e.h.t. switchgear at this substation has assumed impressive dimensions. In addition to the standard incoming and outgoing feeders, each of which is controlled by its own oil switch, there are additional oil switches to control the supply to two short tee-off connections, one supplying Falmer substation and the other Southease and

Newhaven substations. With the addition of the standard rectifier oil switch there are in all five oil switches and 15 isolators at this point. Each feeder oil switch is protected through duplicate isolators, so that work may be carried out with the least interference to the supply. A special reinforced concrete structure at Lewes substation for use on outgoing feeders from which no auxiliary supply is taken, is shown in one of the accompanying illustrations.

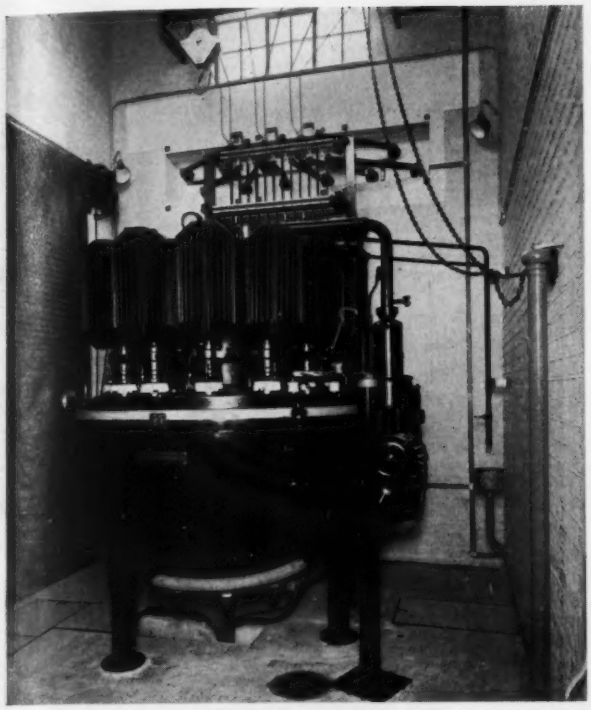
Newhaven substation contains two rectifier equipments, each of which is independent of the other. Falmer substation is provided only with the oil switch and attendant isolators necessary for the control of the main supply to the rectifier, advantage having been taken of its special location to reduce the number of oil switches to a minimum. However, the e.h.t. switchgear is such that expansion on standard lines can be carried out, should this become necessary in future.

The steel tank rectifiers are duplicates of those installed in the 18 substations on the Brighton extension, and of those on the Sevenoaks line, and were built by Bruce, Peebles & Co. Ltd. The continuous rating is 2,500 kW., corresponding to 3,790 amp. on the d.c. side; higher currents can be produced for shorter times, up to a momentary maximum of over 12,000 amp. The rectifiers are water-cooled by means of a closed circuit passing through a radiator, over which air is drawn by a fan thermostatically controlled. As the functioning of a rectifier is vitally dependent upon the degree of vacuum, the facilities in this respect have been carefully arranged.

Top: 33 kV. outdoor switchgear and isolators at Lewes substation

Right: Falmer substation, showing the outdoor 33 kV. switchgear

Below: Plumpton substation showing the equipment for the transformer and rectifier. The e.h.t. switchgear is behind

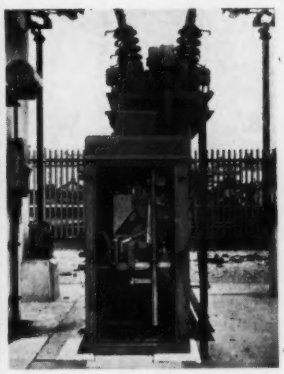


A low vacuum pump of the mechanical type, working in series with a high vacuum mercury diffusion pump, is provided. The latter is operated continuously but the low vacuum pump works automatically as required, the control being effected by a contact vacuum gauge meter. Cooling of the high vacuum pump itself is effected by a closed water circuit which forms a separate unit from the main system.

The local equipment for the e.h.t. switchgear and the rectifier and its auxiliaries is housed in a cubicle faced by a flush type switchboard. This switchboard is divided into three panels, arranged for the e.h.t. switchgear, the rectifier, and the auxiliary devices respectively, and gives visual indication of any possible failure which may occur.

The positive lead from the rectifier is taken through a main high-speed circuit breaker with a continuous-carrying capacity of 4,000 amp. to a busbar. From there connection is made to the track feeders through smaller high-speed circuit breakers. The latter breakers are arranged to trip on forward current, whereas the main breaker trips on reverse current. Isolators are provided on each circuit breaker, so that they can be taken out of circuit without disturbing the supply to the remaining units.

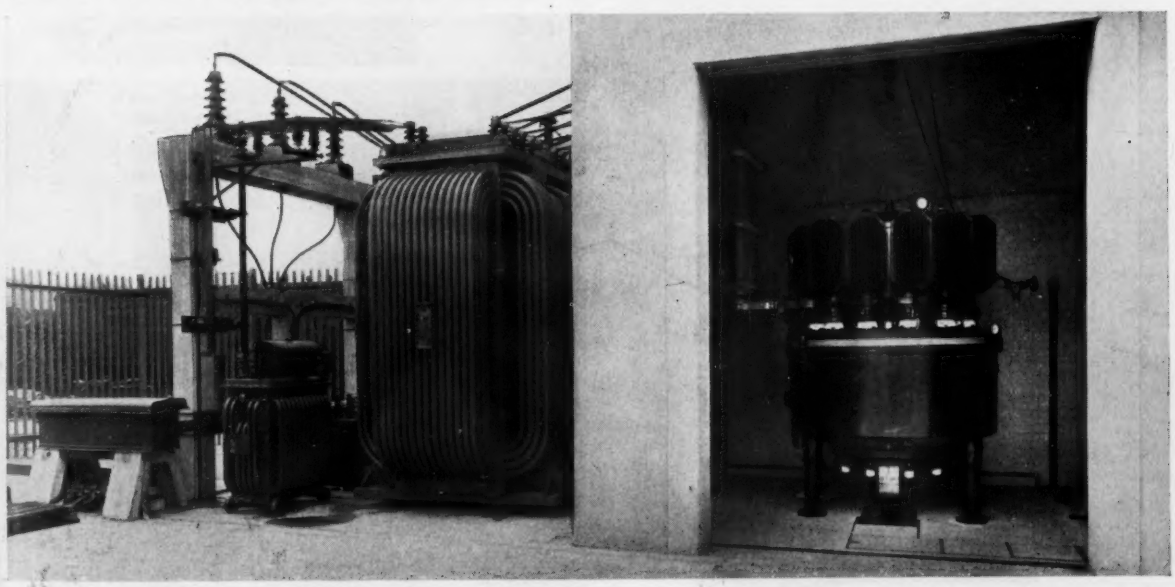
The equipment for the local control of each track feeder breaker is mounted on a special panel, arranged below the circuit breakers. Normally these breakers are closed by current obtained from the adjacent rectifier, but arrangements are provided on certain units for closing them from the tracks when the rectifier is not in operation. The negative feeders, which are connected to the tracks,

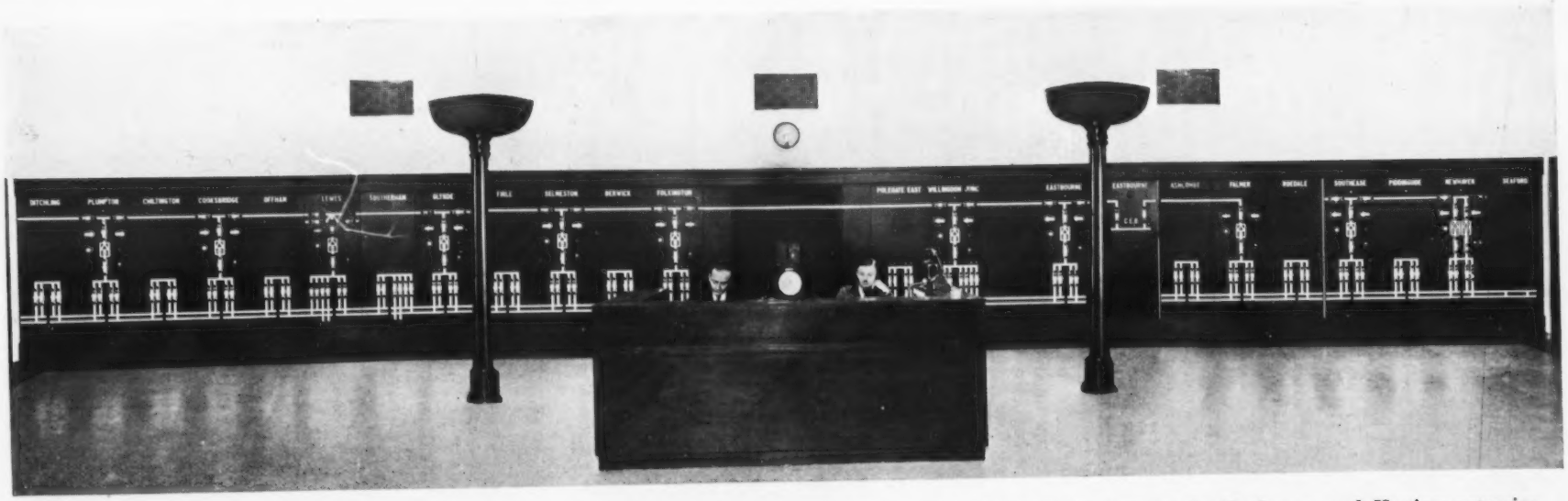


Top: View of 2,500 kW. rectifier showing high and low vacuum pumps

Left: The two far illustrations show the rectifier auxiliary services control panel and the high speed d.c. circuit breakers in Newhaven substation, and the near illustration the details of a 33-kV. oil circuit breaker

Below: Mercury arc rectifier and main oil-cooled transformer at Newhaven substation. The negative busbar equipment can be seen on the left



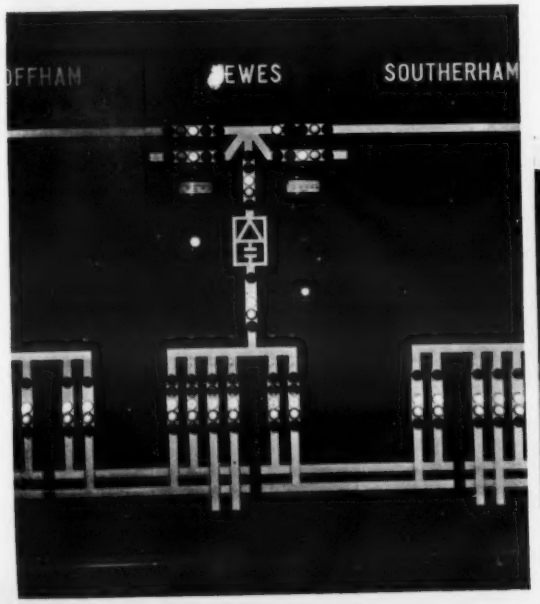


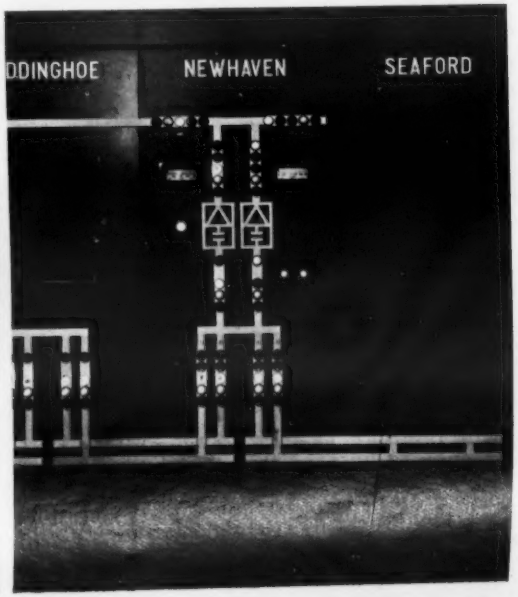
View of the straight wall of Three Bridges control room showing the panels for the substations and track-paralleling huts on the Eastbourne and Hastings extension. The panels for the Brighton line are on the curved wall of the D-shaped room

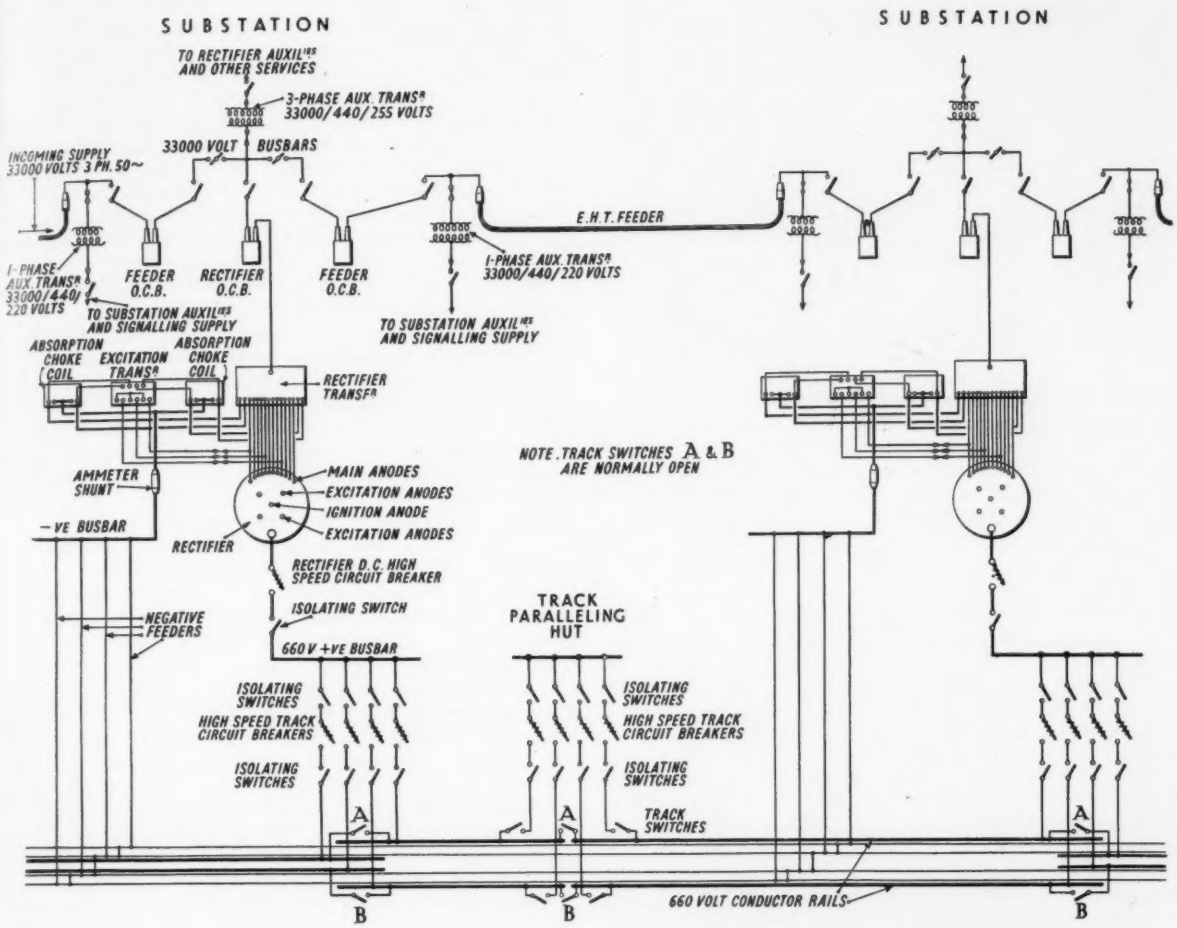
Left: Lewes substation panel at Three Bridges control room

Below: The operators' desk at Ore control room

Right: Newhaven substation panel at Three Bridges control room. Note the indications for the two rectifiers







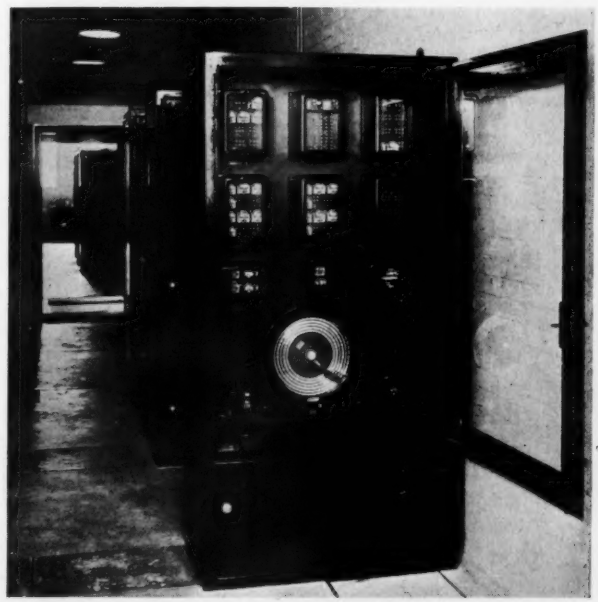
Wiring diagram of standard rectifier substation connections, Southern Railway

return the current to the negative busbar, which in turn is connected to the main transformer through the absorption choke coils. Where it is not possible to attach the negative feeders directly to the running rails, impedance bonds are provided to enable the necessary connections to be made.

Remote Control

The whole of the substation apparatus is arranged for remote operation by supervisory control, and the positions of the circuit breakers in the track paralleling huts are similarly indicated. The control room at Three Bridges has been provided with additional equipment to cover the operation of the Eastbourne extension as far as Willingdon junction and Polegate junction, as shown on the accompanying map. This brings the total number of substations controlled by Three Bridges up to 29. The control panels for the new extension have been arranged alongside the straight wall and are similar to those described in the Supplement on the electrification of the Brighton line, which was presented with THE RAILWAY GAZETTE of December 30, 1932.

A new control room has been erected at Ore to control the substations and t.p. huts between Willingdon and Ore. In design this control room is a duplicate of that installed at Swanley on the Sevenoaks extension, and the panels are arranged on the curved wall, leaving ample room



Remote-control transmitter cabinet installed at Three Bridges

for future extensions in the straight wall. The supervisory control equipment is similar to that used on the previous main line extensions, and operates through groups of dry-core telephone-type cables (lead covered and double steel tape armoured) through a special 60-volt d.c. system.

Each oil switch or d.c. breaker in the mimic busbar is represented by a unit consisting of a red, green, and white lamp and two operating keys. To operate the switch the calling key on the selected unit is first depressed, and this releases a contact arm which rotates over a segmented faceplate in the transmitter cabinet. The rotation of this arm causes the synchronised step-by-step rotation of a similar arm in the distant substation. When this arm reaches the corresponding position of that of the key depressed it stops, if all is in order, and a white lamp on the switch unit is automatically lighted, indicating that this part of the procedure has been carried out. Simultaneously the arm in the distant substation stops. If for any reason the position of this arm does not exactly correspond with the arm in the transmitter cabinet, electrical interactions occur to resynchronise the two arms. Immediately these two arms get into step they rotate together to the selected position. The single white lamp mounted on the left of the substation switchboard panel remains dark while the resynchronising is taking place, and during this time the operating and signalling units are automatically disconnected, to prevent faulty working. With normal operation of the selector this white lamp glows steadily, but flashes intermittently while the selector is moving from one position to another. When the white lamp above the calling key lights up, the desired operation of the distant oil switch or circuit breaker may be performed by means of the second key. Pressing this key downwards closes the switch and an upward movement opens it. Correct operation is indicated by the lighting of red or green lamps, depending upon whether the switch is closed or open.

For the operation of the e.h.t. feeder oil switches an additional lamp with an orange shade is provided. This lamp indicates any frequency difference which may occur between the two supplies on either side of the switch before closing. When the two supplies are exactly in synchronism this lamp glows steadily. With the supplies out of synchronism, the lamp blinks at a rate dependent upon the difference in the frequency. This orange lamp is only in circuit when one of the substation feeder oil switches is called. It indicates to the operator when it is safe to parallel the two supplies, but no attempt is made to parallel the supplies at the substations unless confirmation has been received from the C.E.B. that the corresponding 132-kV. supplies are in parallel. All the supervisory equipment is of the plug-in type to facilitate its removal and the insertion of spares without disturbing the wiring and other connections.

Transmitter cabinets for supervisory control, Ore control room

To put a substation into commission it is only necessary to close the oil switch controlling the rectifier transformer. Other auxiliary equipment at the substations comes into use automatically, and is so interlocked that it prevents remote operation of the substation if the conditions are not satisfactory. The load conditions of the distant substation are indicated on the control panel by instruments which are connected in circuit, when a special meter key is operated. The volt and ampere readings of these meters are transmitted over the selector pilot cables by means of the balanced-beam potentiometer system.

All the oil switches and high-speed circuit breakers are provided with protective arrangements. When one of these switches is opened, due to a fault, the fact is signalled to the control room by the ringing of a bell and the flashing of the clear lamp at the top of the panel belonging to the particular substation. At the same time a coloured shutter is exhibited on the control desk. These conditions continue until the control room attendant has actuated a resetting key. To discover which of the switches has automatically operated, a checking key is used. The operation of this key causes the selector arm to rotate once round the faceplate and to connect in succession each one of the switches in the substation to its particular unit in the control room. When the selector arm passes over the contacts corresponding to the switch that has tripped, a current will flow and cause the indication on the control panel to change from red to green. The attendant then selects this particular switch by means of the calling key and clears the fault indicated either by reclosing the switch or confirming its new position by moving the key.

Certain portions of the equipment, such as the main high-speed circuit breaker and those fitted in the track paralleling huts, are entirely automatic in operation and the fault indication given by the breakers is automatically removed as soon as the indications on the control board correspond with the actual position of the breaker. Indications of the position of the railway's e.h.t. feeder switches in Eastbourne C.E.B. substation and also certain switches in Willingdon traction substation, are provided in the control rooms of both Ore and Three Bridges, in order that the attendants at these two rooms may be informed of the exact conditions of supply. One of the results of this arrangement is that the substation oil switches, rectifier, and four track feeder switches at Willingdon substation which feed the Eastbourne branch, are all controlled from Three Bridges, whereas the two feeders supplying energy to the Hastings line are controlled from Ore. Indication at Ore control room is also provided for the main high-speed breaker at Willingdon, and a further indication is provided to show whether the d.c. busbar in the substation is alive or dead. The operator at Ore is thus aware of the conditions of supply and is in charge of the feeders to the system controlled by him.

The desk in each control room accommodates a private telephone exchange to all substations and t.p. huts, with a fault indicating system for each of these points, as well as a system of calling keys for testing the supervisory

pilot system. Plug points are provided at the base of the panels and in the transmitter and receiving cabinets for portable telephones, so that telephonic communication is available between all points on the system. Each control system is fed from two 120 volt, 250 amp. hr. centre tapped storage batteries, and the checking signals are originated from similar batteries of 50 amp. hr. capacity in the distant substations.

The substation batteries are normally trickle-charged by means of metal rectifiers, but arrangements are made for a full charge if desired. The control room batteries are charged through comprehensive equipment; two supplies, one 660 volts d.c. from the conductor rail, and the other 440 volts a.c. from the local substation, are brought in for charging purposes. These two supplies are converted by separate motor generator sets to d.c. for charging the batteries. The entire equipment is automatic in action and is arranged to maintain the supply of current to the control board and supervisory system should either or both of the sources of supply fail.

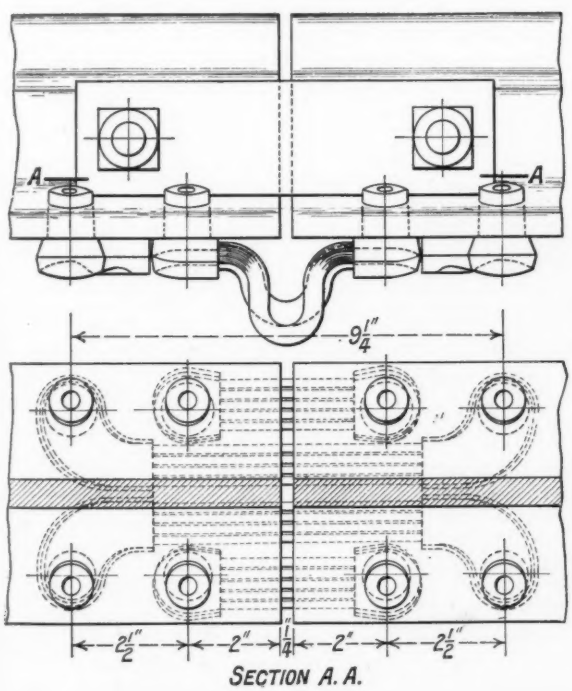
Normally one supply is selected to charge the batteries and continues to do this until both sets are fully charged. The generator then takes over the supply of energy for the control board and trickle charges the battery, the remaining battery acting as a stand-by. If the supply to the motor generator fails, the other unit is started up automatically to carry on the services of the first set. Should both supplies fail, then the two batteries are automatically paralleled to supply the supervisory requirements, and when one or both of the supplies is restored, the corresponding motor generator starts up and proceeds to charge the batteries, repeating the cycle described above.

Conductor Rails

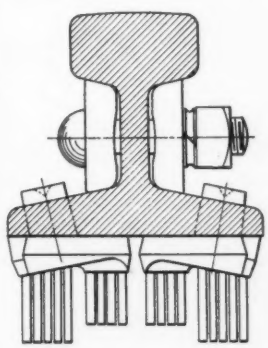
The conductor rails are of the Southern standard flat-bottom section and weigh 100 lb. per yard. They are supported on porcelain insulators, of which there are generally about 620 to the mile. The rails are normally in 60-ft. lengths and are bonded together by four copper bonds having a total cross-sectional area of 1·68 sq. in. The running rails are used to provide the negative traction circuit, and for this purpose they are bonded together by two copper bonds per joint which have an aggregate c.s.a. of 0·332 sq. in. These bonds are of the protected type and consist of several copper strips laid between the web of the rail and the fishplate. At points and crossings and in other positions where protected bonds are impracticable, stranded bonds are used and these are also utilised to form the cross bonds between the running lines. Negative cable is used for cross-bonding at positions where the permanent way conditions are difficult.

Hook switches are provided for isolating sections of the conductor rail and are also provided between the feeders and the conductor rails. They are bolted to the conductor rails, as shown in one of the accompanying illustrations, and are operated by wooden poles with a metal hook at the end. These poles are kept at strategic points and are used only on the instructions of the control room attendant, to whom telephonic communication can be made.

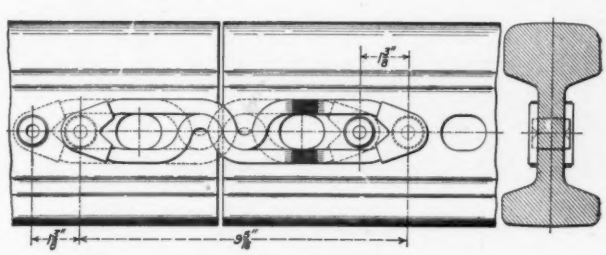
Hook switch between feeder cable and conductor rail



SECTION A. A.



EACH BOND COMPOSED OF 60 STRIPS OF ·2" x ·035" COPPER.
SECTIONAL AREA = ·42 SQ. INS.



Standard methods of bonding rails on the Southern electrified lines

Left: 100 *lb. conductor rails*

Below: Running rails

New Electric Rolling Stock

TO meet the traffic requirements for the extension of the electrified services to Eastbourne, Seaford and Hastings, the following units have been built, to the designs and under the supervision of Mr. R. E. L. Maunsell, Chief Mechanical Engineer of the Southern Railway:—

33 two-car compartment sets
10 two-car corridor sets
17 six-car vestibules

The two-car compartment units were converted at the Southern Railway works from Western Section steam stock. The underframes and bogies of these vehicles are quite new. The trailer coaches for the corridor and vestibuled sets have been built by the Southern Railway, but the order for the motor coaches was divided equally between the Birmingham Railway Carriage & Wagon Co. Ltd. and the Metropolitan-Cammell Carriage & Wagon Co. Ltd. The electrical equipment for the new stock was supplied by the English Electric Co. Ltd. (traction motors); the Metropolitan-Vickers Electrical Co. Ltd. (train control equipment); and the British Thomson-Houston Co. Ltd. (train control equipment).

Non-Corridor Compartment Trains

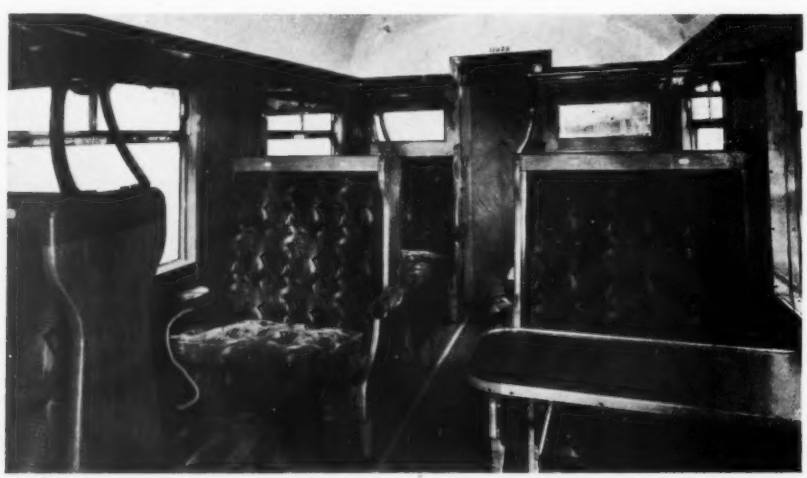
The two-car non-corridor units are formed of one motor third brake and one driving trailer composite permanently coupled together. The dimensions and appearance of these vehicles are generally similar to those of the standard 8-ft. wide suburban stock, but the motor-coach includes a third class coupé compartment, a feature found in certain trains running in the London district. The electrical equipment of these sets corresponds generally with that on the latest type of suburban train, but only two 275 h.p. self-ventilated nose-suspended motors are used for the two-car set taring 70 tons 15 cwt. compared with the four on a three-car suburban set taring 101 tons.

Semi-Fast Rolling Stock

The two-car non-vestibule corridor sets are for use on semi-fast and slow trains, and will be made up into units of two, four, six or eight cars, as required. One of the vehicles is a motor third and the other a composite driving trailer. Lavatory accommodation is provided in each. In the driving trailer it is common to both first and third class passengers. The driver's compartments in both the motor-coach and the driving trailer are fitted with the usual Southern Railway pattern of hinged seat secured to the door. A guard's and luggage compartment, with approximately 60 sq. ft. of floor space is provided in the motor-coach. The total seating capacity is 24 first class and 88 third class, arranged as shown on one of the accompanying diagrams, and the tare weight of the set is 74 tons 15 cwt. This stock is 9 ft. wide.

The underframes are constructed from steel sections, and the bodies have timber frames of oak, teak, mahogany and pitch pine covered with steel panelling outside. The first class compartments are finished with American walnut and the third class with African mahogany and birch plywood; the ceilings of both are painted with white glossy enamel. The floors of the first class smoking compartments are covered with rugs of goat hair, and those of the non-smoking compartments with Tournay rugs; the third class compartment floors are covered with Granite inlaid linoleum, the flooring itself being of corrugated steel, suitably bonded for taking Decolite flooring composition. The corridor sides of the compartments are fitted with single sliding doors, a reversion to previous practice. Frameless windows have been provided in the compartment doors of the new stock and are fitted with Beclawat patent weatherproof window fittings. The off-side end window of each driving compartment is of the hinged type, and the cabins of the two-car non-corridor and six-car vestibuled trains have similar driving arrangements.

The electrical equipment of the trains was Mr. Raworth's responsibility, and is similar to that of the later designs of the company's existing suburban electric rolling stock. The lighting and heating equipment is of an improved type, and electric water heaters of the storage type, specially designed for the purpose, have been installed in the lavatory compartments. The power for this purpose is taken from a 600-volt main, and each heater is thermostatically controlled. A Birka vacuum switch is used to control the 660-volt supply to the heaters, in place of the usual electro-magnetic contactors. Each motor-coach is equipped with two 275 h.p. nose-suspended traction motors of the totally-enclosed self-ventilated type.

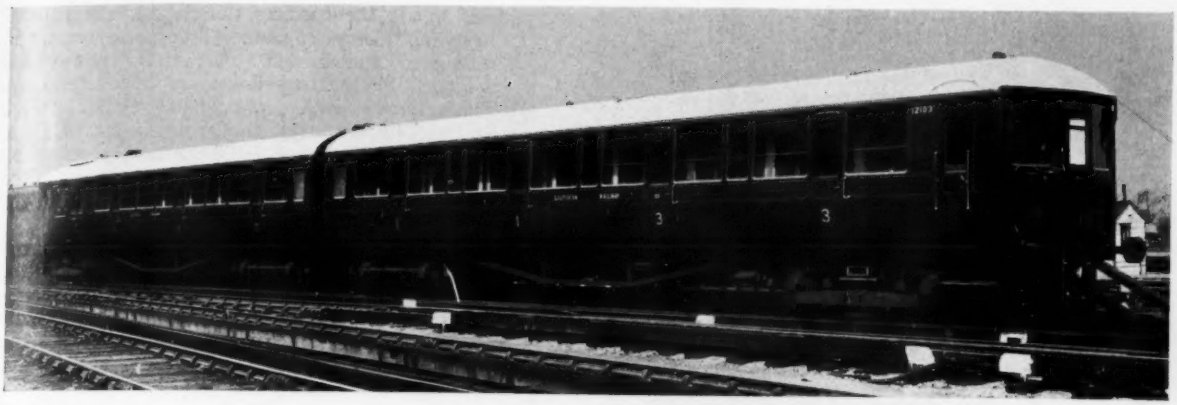


Interior of third class saloon in one of the new motor-coaches built for the Eastbourne and Hastings trains

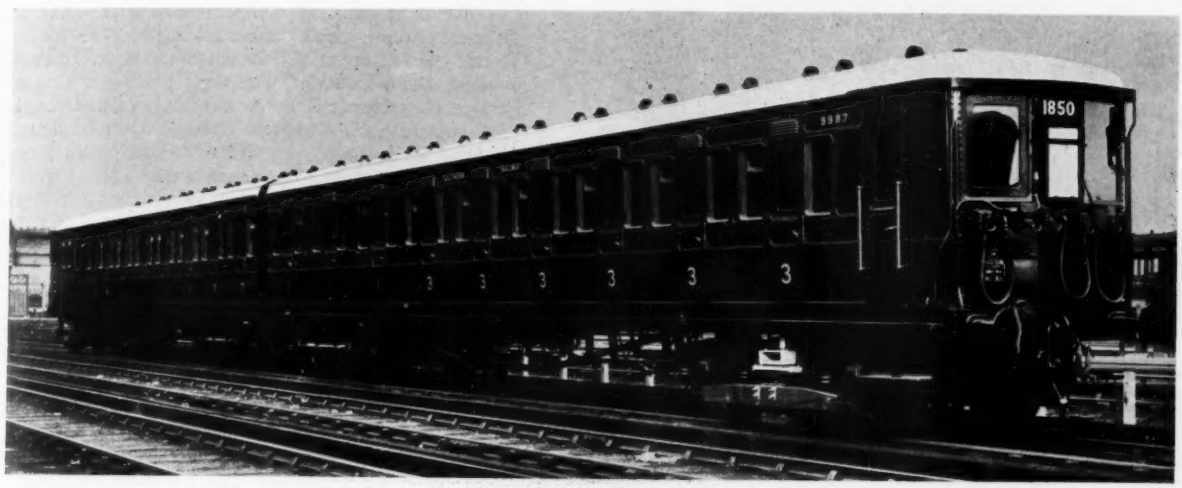
Express Trains

The 17 six-car vestibuled trains differ from the Brighton stock by the substitution of a buffet car for the Pullman kitchen-parlour car. The layout and dimensions of the complete train and of the different types of vehicle may be seen in accompanying diagrams.

The motor-coach saloon thirds are of all steel construction, as it was felt that this system has many advantages over the usual timber bodies and trussed underframes when numerous items of electrical apparatus and air brake equipment have to be carried. The interiors of the saloons are beautifully finished in mahogany with figured panelling,

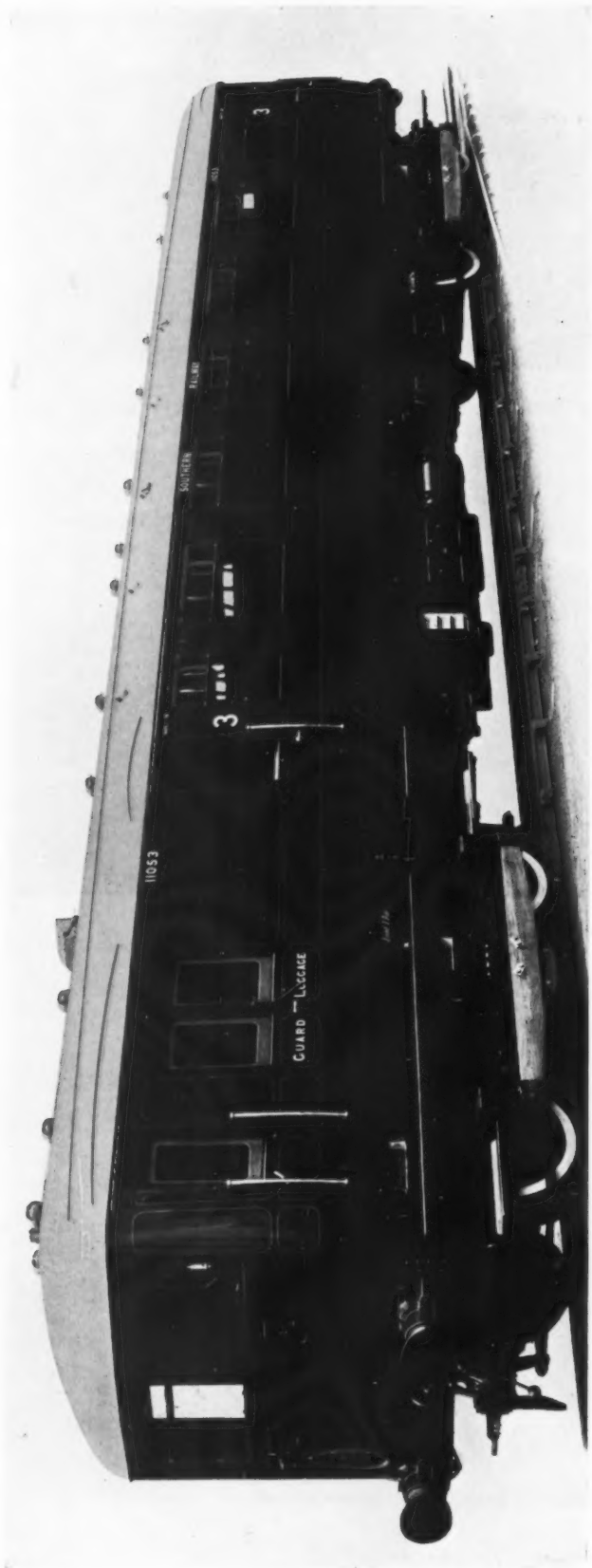


One of the two-car corridor non-vestibuled sets for semi-fast and slow services



A two-car non-corridor set as used on the Horsted Keynes to Seaford and other slow trains

A six-car vestibuled set passing Polegate junction



All-steel third-class motor-coach as used at each end of the six-car vestibuled trains on the Eastbourne and Hastings services

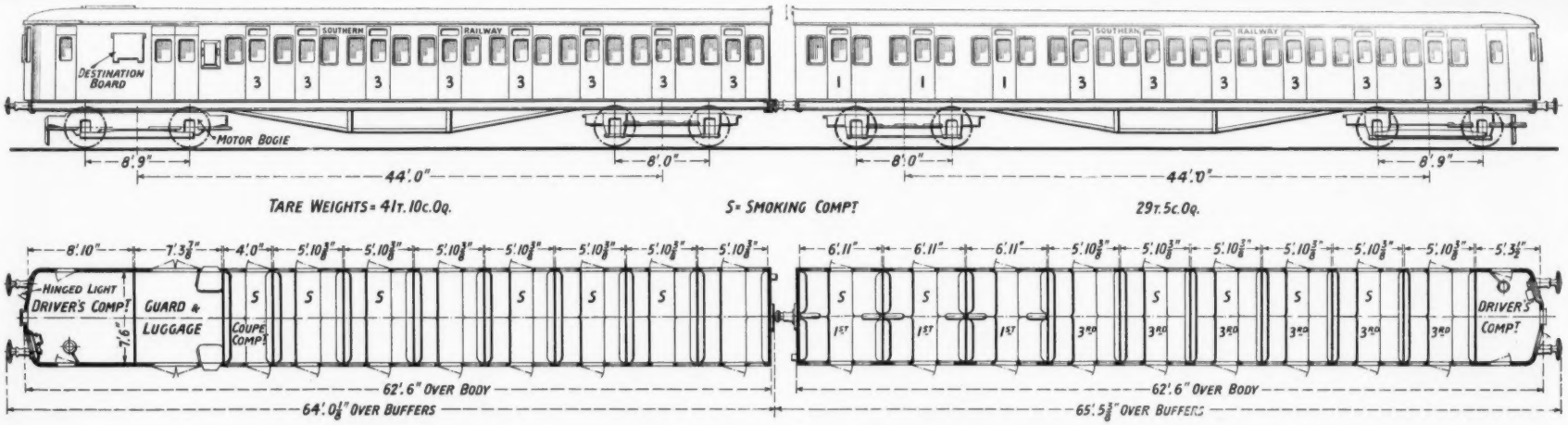
and above the cornices the ceilings are painted in white glossy enamel. Transverse seats, all numbered, and divided by a central gangway, are arranged all the way down the saloon, and are fitted above with light metal parcel racks. Throughout the train, the armrests are of Dunlopillo rubber covered with the normal material. Table fixings are fitted for the use of a limited number of portable tables, which are stored in the guard's compartment.

Large fixed windows with Alpax frames are provided in the saloons and above them are fitted Mead, McLean Limited's patent Airstream ventilators, the efficient action of which does away with the necessity for drop lights. These fittings are described in detail later. The large windows have divided roller blinds which can be secured in two positions. The 29 electric lamps in the saloon and vestibule are under the control of the passengers except for four in the smoking compartment, two in the non-smoking compartment, and three in the vestibules. Bell pushes giving communication with the buffet car are attached to the side panels below the windows. The floor plating is of corrugated galvanised steel overlaid with Decolite or Induroleum, which is covered with linoleum. Trap doors in the guard's compartment floor enable the motors to be inspected.

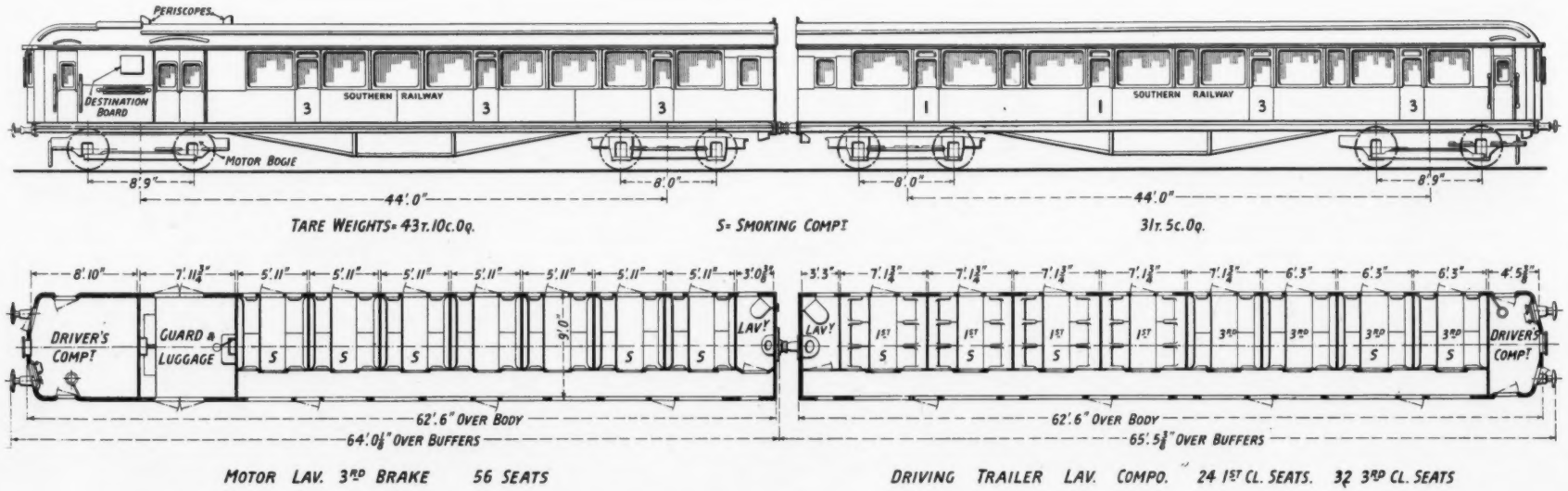
With the object of improving the passenger movement between the coaches and decreasing the noise and maintenance of the usual connections, a new type of vestibule has been incorporated. It is of larger cross section than the standard British type and is covered with Spencer Moulton's elastic fabric, the main constituents of which are rubber and cotton. The equipment of the guard's and luggage compartment includes a periscope, seat, desk, letter rack, expanding ladder, brake valve, and emergency equipment.

The two motor bogies beneath each motor-coach are virtually of the standard equalising beam type as used on the Brighton stock, and illustrated and described in the Brighton Electrification Supplement presented with THE RAILWAY GAZETTE for December 30, 1932. Among the small differences in detail are a slight modification to the springing and the substitution of a cast steel pedestal and centre in place of the previous built-up structure. The bogie wheelbase is 9 ft. and the wheel diameter 3 ft. 7 in., as before. Braking is on the Westinghouse system with equalised clasp rigging applying two blocks to each wheel, and a hand brake is incorporated also. The brake cylinders are of the Prestall type, 18 in. in diameter, and in accordance with standard Southern practice each is fitted with a slack adjuster.

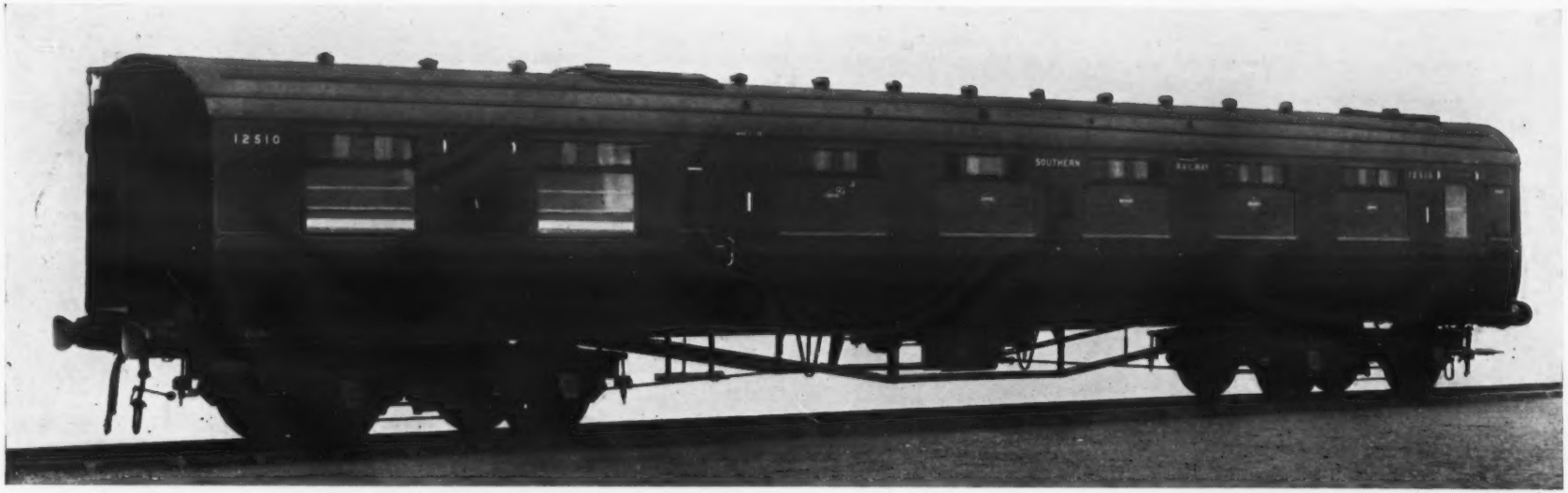
The electrical equipment of the trains and its installation were the responsibility of Mr. Raworth. Each motor-coach is fitted with four 225 h.p. totally-enclosed self-ventilated motors, and a set of electro-pneumatic control gear arranged for series-parallel control and mounted beneath the underframe. Although the normal service speed of the trains will not exceed 75 m.p.h., the motors are safe for 90 m.p.h. The contactors, line switches, reversers and other details are housed in cases which can be removed from beneath the underframes without disturbing any cables or conduits. Automatic acceleration



General layout of two-car compartment non-corridor train rebuilt from steam stock of the Western Section for slow trains on the Eastbourne and Hastings electrified lines

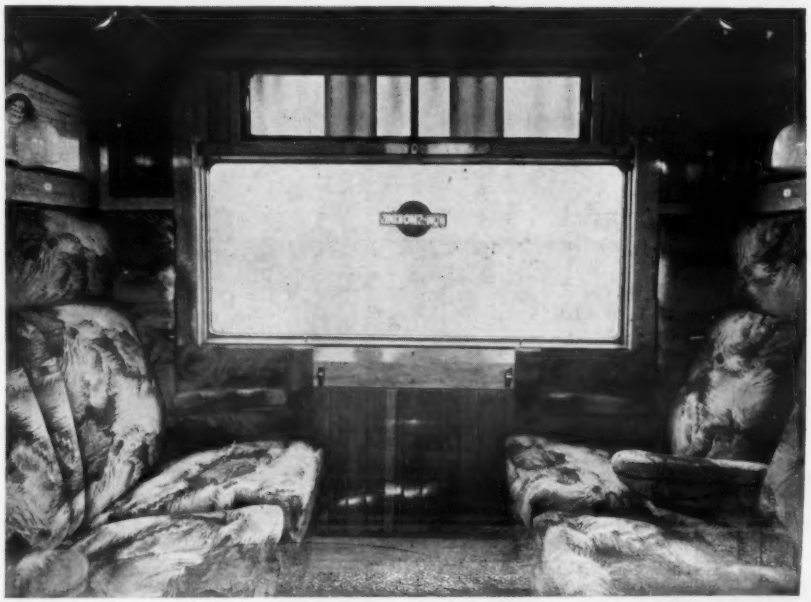


General layout of new two-car corridor compartment train suitable for making up into four, six, or eight-car sets for various services on the newly electrified lines of the Southern Railway



Exterior view of first-class buffet car built by the Southern Railway for the Eastbourne and Hastings trains

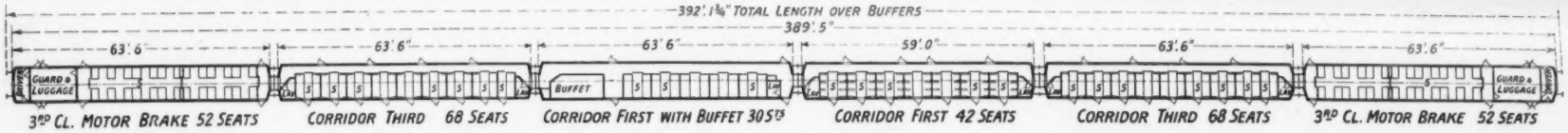
Interior of buffet car showing clear view obtained through corridor windows



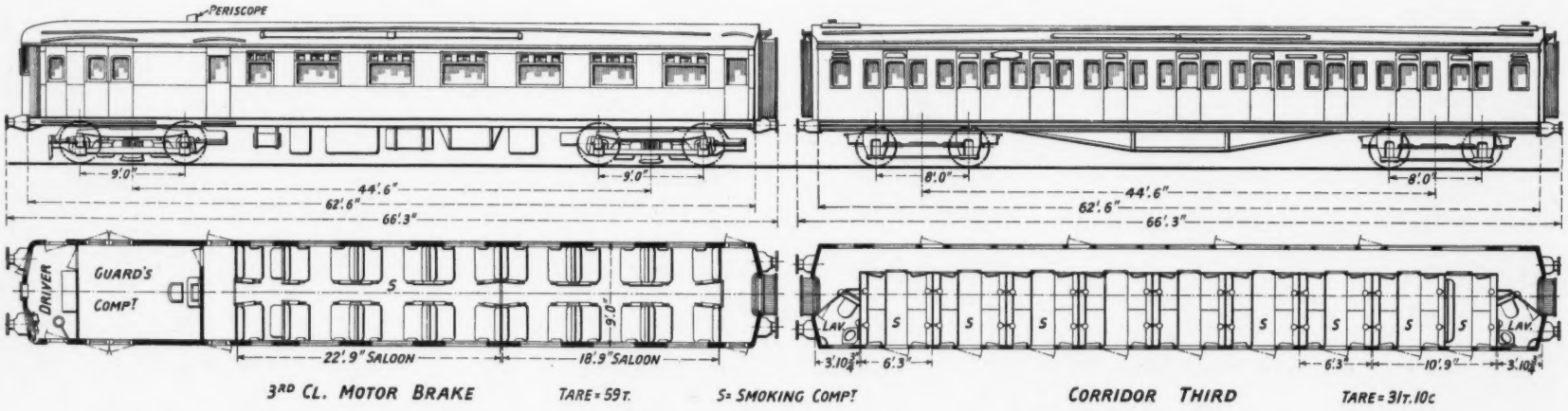
Interior of compartment in buffet car, showing the Airstream ventilators

Interior of buffet car showing clear view obtained through corridor windows

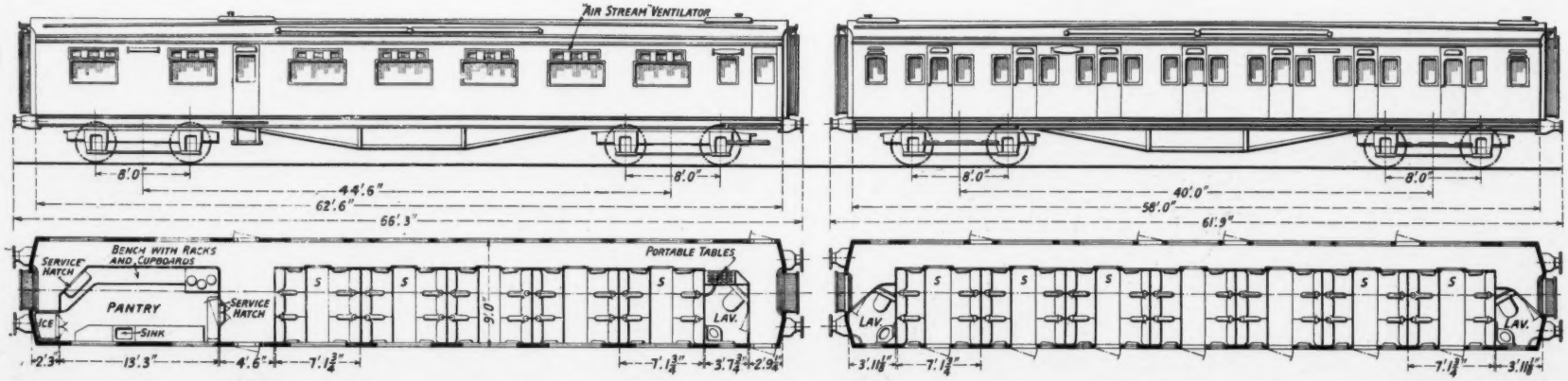
Interior of compartment in buffet car, showing the Airstream ventilators



General diagram of new six-car express electric train with buffet car, Southern Railway



3RD CL. MOTOR BRAKE TARE = 59 T. S = SMOKING COMP.T CORRIDOR THIRD TARE = 31 T. 10 C



CORRIDOR FIRST WITH BUFFET TARE = 32 T. CORRIDOR FIRST TARE = 31 T.

Diagrams showing general dimensions and layouts of the various types of vehicles making up a standard six-car vestibuled set for the Eastbourne and Hastings electric services

of the train is given through two limit relays mounted in the driver's cab. Further apparatus in the cab includes the master controller, with dead man handle attachments; control switches; auxiliary switch panel; ammeter; pilot lamps for the 600 and 70 volt circuits, and a speed indicator.

A motor generator of 5 kW. capacity, fitted with a voltage regulator, is carried beneath each motor-coach to provide the 70-volt lighting and control circuits. Emergency lighting batteries of the Nife (nickel-iron) type are carried in a steel cupboard between the guard's and driving compartments, and can maintain the train lighting for half-an-hour should the 600-volt supply from the track fail. Throughout the train, a certain proportion of lamps are under the control of the passengers and the remainder under the control of the guard.

Vestibuled Trailers

The trailers of the six-car trains are of three types, *viz.*, two corridor thirds; one corridor first; and a corridor buffet car; all are of the side-corridor compartment type. The same type of bogie and brake rigging is used under all the trailers, but the design differs somewhat from that used on the Brighton stock and is of the standard suburban type. Prestall cylinders of 14 in. diameter provide the braking power. No departure from the standard details of body construction have been made, and the framing is of timber with steel panelling at the sides and ends. The underframes are of steel section substantially cross-braced, especially at the pivot centres.

The interior finishing of the first-class compartments is in complete schemes embodying the use of silver-grey wood and Nigerian walnut. The third-class compartments are finished in African mahogany and relief is obtained by the use of figured mahogany plywood panels. In a general way the interiors are similar to those of the Brighton stock. An innovation in the first-class compartments of the buffet cars is the absence of doors on the non-corridor side and the substitution of large observation windows. Moreover, the outside doors in the corridor have been arranged between the compartments, and an excellent view is obtained from both sides of the carriage. The outside doors in the first and third-class compartments have drop windows and are of a new Beclawat weather-proof type in which a water trap is incorporated in the bottom panel; this leads any water which may find its way inside down through channels which drain through the bottom of the door.

The improvements made in the windows and certain other details have been rendered possible mainly by the provision of the new type of ventilator already referred to known as the MM Airstream ventilator. This device is fitted in two movable frames above each large fixed window and consists simply of a concave glass deflector close to the fixed panel as shown in the illustrations of the stock. A stream of fresh air is guided along the inside face of the deflector by the forward motion of the car, and the major portion of the stream escapes through the rear opening by reason of the flaring of the deflector at this point. But a certain amount of the introduced air remains in the carriage and displaces the vitiated air through the rear opening. Through the combined action of the fresh air stream and the escaping used air, outside currents cannot penetrate past the rear edge. The air in the vehicle is being changed continuously and the rate of change can be regulated by pushing the rear of the two movable frames in the direction of the train movement. We observed carefully the action and effects of this ventilator on the occasion of trial runs, and were surprised at the adequate ventilation which was obtained without draught being felt in any seat or when standing in the corridor or central gangway. Tests have been carried out in saloon compartments which were heavily charged with smoke, and a single ventilator was very effective in clearing this away in a short time.

The first-class buffet car is a beautifully upholstered vehicle containing five first class compartments with removable tables. The kitchen is at one end of the vehicle and has two serving hatches. It contains one of Still's electric water heaters for making tea or coffee, in addition to the usual cupboards, sink, plate racks, &c. The hot water service in the kitchen is similar to that fitted in the lavatories throughout the train. The water heaters are of the storage type supplied with 600-volt current from the conductor rail and are controlled by thermostats which operate on the 70-volt auxiliary supply to control contactors in the main 600-volt heating circuit. Heating of the passenger compartments in all the trailers is effected by a tubular electric heater fitted beneath each seat; the heaters are fed from separate circuits so arranged that one or both may be on as required. In the open saloons of the motor thirds, the heaters are of the spiral-wound open-coil type.

The exteriors of the coach bodies of all the stock are painted in the Southern standard shade of green, panelled out with yellow lines shaded black, and lettered and numbered in the usual manner. The roof is painted white and the underframes and bogies black.

Main Contractors for the Electrification of the Eastbourne and Hastings Lines

Asea Electric Limited.
British Insulated Cable Co. Ltd.
British Thomson-Houston Co. Ltd.
Bruce, Peebles & Co. Ltd.
Chloride Electrical Storage Co. Ltd.
Doulton & Co. Ltd.
British (G.K.B.) Iron & Steel Co. Ltd.
English Electric Co. Ltd.
Estler Bros. Ltd.
Macintosh Cable Co. Ltd.
Metropolitan-Vickers Electrical Co. Ltd.
Pirelli-General Cable Works Limited
Taylor, Tunnicliff & Co. Ltd.
Beckett, Laycock & Watkinson Limited.
James Beresford & Son Ltd.
Birmingham Railway Carriage & Wagon Co. Ltd.
Lightalloys Limited.
Mead, McLean & Co. Ltd.
Metropolitan-Cammell Carriage & Wagon Co. Ltd.
J. W. Roberts Limited
Geo. Spencer, Moulton & Co. Ltd.
Taylor Bros. & Co. Ltd.
Westinghouse Brake & Signal Co. Ltd.
Barrow Hæmatite Steel Co. Ltd.
Bayliss, Jones & Bayliss Limited
Christiani & Nielsen Limited
Guest, Keen & Nettlefolds Limited
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